SCIENTIFIC AMERICAN

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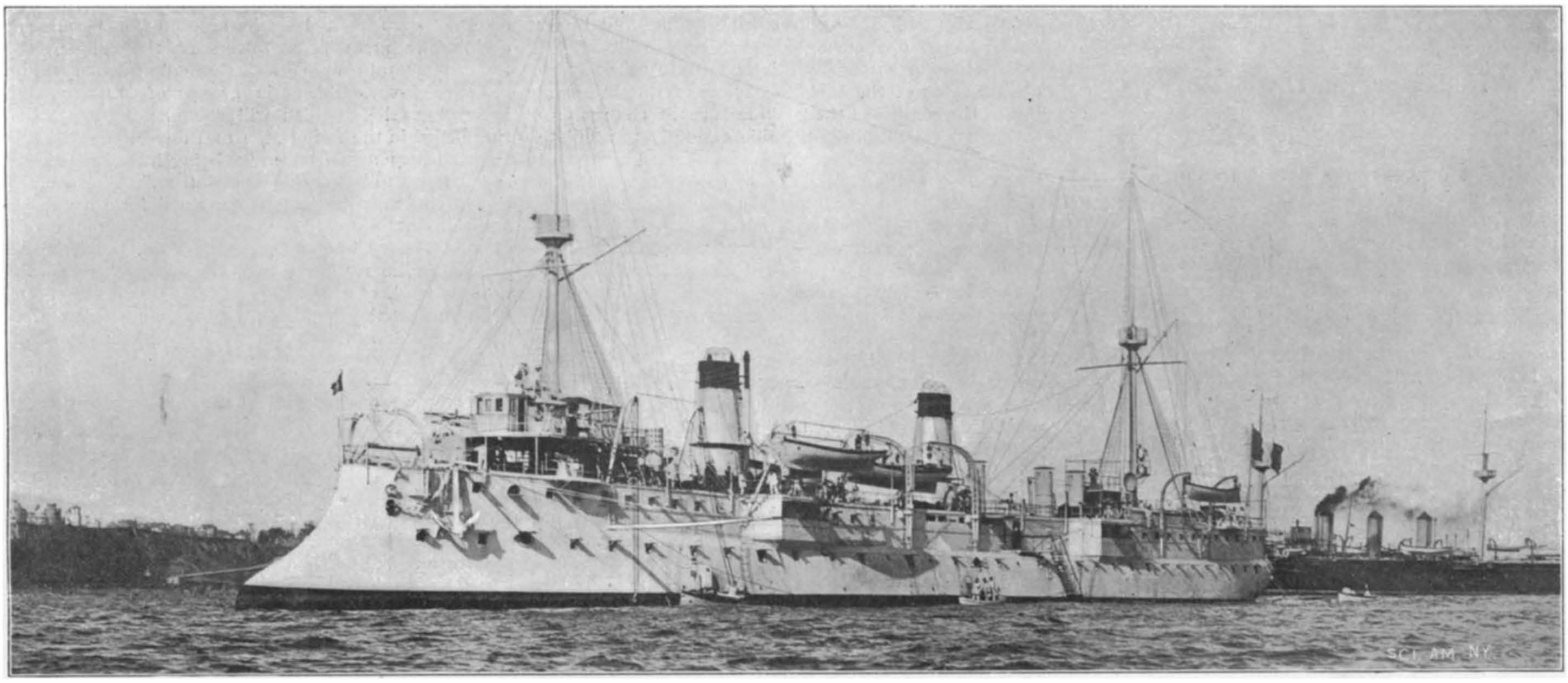
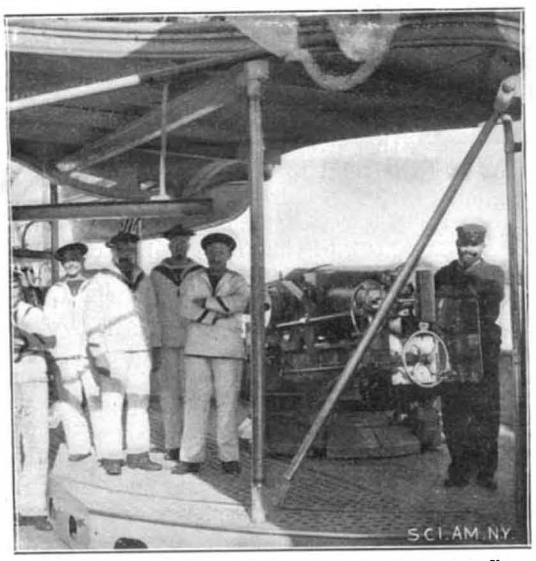
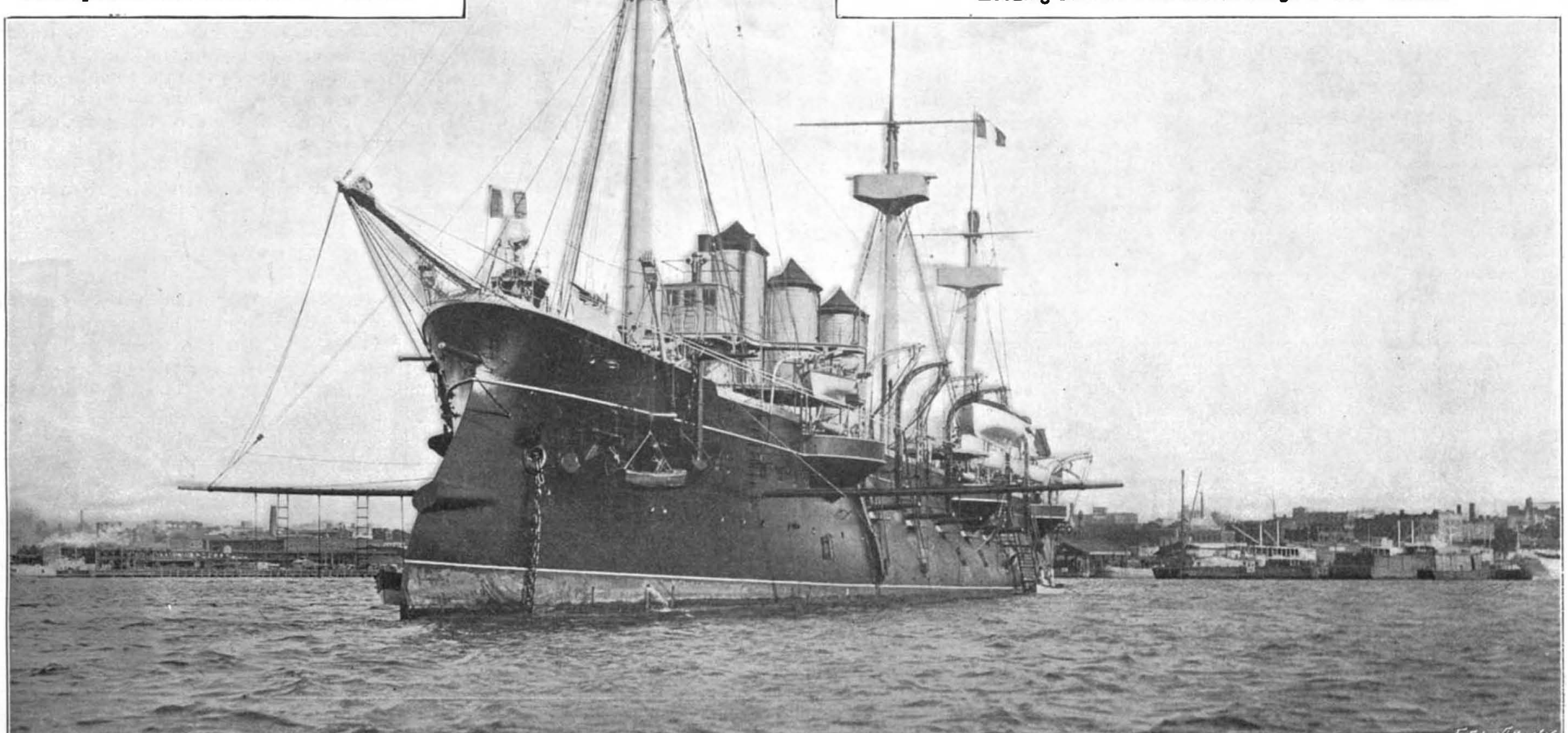


Second-Class Cruiser "Suchet."



Port Sponson Gun Amidships on "Cecille."

Looking Aft from the Main Bridge of the "Cecille."



Second-Class Cruiser "Cecille."

VISIT OF FRENCH CRUISERS "CECILLE" AND "SUCHET" TO NEW YORK.—[See page 278.]

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NEW YORK, SATURDAY, NOVEMBER 3, 1900.

IRRIGATION IN THE EASTERN STATES.

An important part of the work of the United States Department of Agriculture is the irrigation of arid lands, an undertaking which is being carried out by the Office of Experiment Stations in various regions of the United States. Owing to the great importance of the subject to the farmers of the Western States, for whose success irrigation is a positive necessity, the greater part of the experimental work of this office is being done on the arid lands which were formerly known as the Great American Desert, but which under the influence of irrigation have proved to be remarkably productive. It must not be supposed, however, that the need for irrigation exists only in the region west of the Mississippi River; for the many crop failures which have occurred in the Eastern States have drawn attention to the necessity in this region also for storing the flood waters of the rainy season, or if that be not practicable, of erecting pumping plants to make good the shortage in seasons of drought.

Although the losses due to drought are not anything like so serious in the East as in the West, they are still sufficiently large to justify the installation of irrigation plants. Prof. E. B. Vorrhees, of the New Jersey Experiment Station, estimates that as the result of his observations and experiments in 1899 he found the loss to the hay crop of New Jersey from drought during May and early June of last year to be $1,500,000, while vegetables and small fruits suffered even more seriously. That damaging droughts are not infrequent is shown by the rainfall records in Philadelphia during the seventy years from 1825 to 1895, which prove that in eighty-eight per cent of these years there was a deficiency of more than one inch for one month; that is to say, in sixty-two years out of seventy, there was one month in the growing season in which there was so marked a decrease of rainfall that a serious shortage of crops resulted. For the same period there were thirty-nine years in which the deficiency extended throughout two months, while in twenty-one years the deficiency extended throughout three months, the average rainfall during this growing period being deficient by one inch or more.

The investigation by Prof. Voorhees was made for the purpose of determining whether the increased yield resulting from irrigation during these three months would be sufficient to pay for the necessary storage or pumping plants. Careful records were kept of the yields of plots of ground which received the same cultivation, except that some of these were irrigated and others depended upon natural supplies of moisture. The increase in the yield of the irrigated plots over the others varied from 339 quarts of raspberries per acre, worth $22.90, to 1,030 quarts of blackberries per acre, worth $93.42.

The cost of plants of the size necessary to supply ten acres of small fruits and garden crops has varied in the different experiments from $230 to $500. While returns have not been made from all of the plants which were under observation, the owners are in every case satisfied that their outlay has been returned with considerable profit; while in nearly every case they state that they have paid for the plant with the receipts of increased crops during the first year it was in operation.

The results obtained by Prof. Voorhees are of unquestionable value; for the climatic conditions of New Jersey are fairly typical of the United States east of the Mississippi River. The report has greater practical value to-day than it would have had twenty years ago, for there are now upon the market many exceedingly economical forms of motive power, such as improved windmills and highly economical internal combustion motors, which do not cost much to install, and the running expenses of which are light; the windmills indeed costing practically nothing after erection.

A 40-KNOT STEAM YACHT.

Quite apart from its spectacular features, the phenomenal development which is just now taking place in the art of building extremely high-speed craft of the pleasure-yacht or torpedo-boat type is of the most vital interest to the builders of large, high-speed, ocean-going vessels, whether in the navy or merchant marine. When Mr. Parsons with the "Viper" and Mr. Mosher with the "Ellide" succeed in attaining speeds of 37 knots and 34·73 knots with their respective craft, they are "blazing the way," as it were, in a comparatively untried field of investigation, for the production of ocean steamships which as the years go by will undoubtedly approach the same speeds.

The incredulity with which the mere suggestion of such speeds in ocean steamers is received is due to the recognition of the fact that the present system of steam boilers and steam engines involves such an enormous increase of weight for a relatively small increase of speed that the limit of speed with Scotch boilers and engines of slow revolution has been very nearly reached. But to state that higher speeds can never be attained is to assert that finality in marine engine and boiler design has been reached.

For obvious reasons it was impossible to take any indicator cards of the turbine engines of the "Viper;" but as the engines of the "Ellide" are of the reciprocating type, it has been possible carefully to tabulate the results of the trial on which she achieved her record speed. The results showed that by the use of water tube boilers, carrying a pressure of 390 pounds to the square inch, and engines of extremely light construction running at 822 revolutions per minute, an indication of 910 horse power can be obtained in a craft whose displacement is only 13 tons. This represents 70 horse power per ton. There is now under construction by the same designer a twin-screw steam yacht, which is to be of 60 tons displacement, and whose engines are designed to indicate 4,000 horse power and drive the craft at a maximum speed of 40 knots per hour. The success of the "Ellide," and the fact that the new yacht is an enlargement and improvement of the principles of design embodied in the earlier boat, render it probable that this speed will be attained.

In the current issue of the SUPPLEMENT will be found a lengthy article which gives a full description and drawings of the new craft, and all who are interested in the development of steam navigation, whether for pleasure, war, or profit, will find the article of extreme interest. Of course, there is an enormous step from a 60-ton river craft to a 20,000 or 30,000-ton ocean liner, but the fact that 4,000 horse power is to be developed from two boilers whose combined weight is only 12 86 tons may well demand the serious attention of marine architects who are now engaged in designing, or getting ready to design, the latest express ocean steamers. Horse power is the product of pressure and velocity. By the use of water tube boilers pressures may be enormously increased and weights reduced, while in the engines the speed of revolution may be quadrupled, with a corresponding reduction in weights.

Doubtless the fast-running engine and the water tube boiler would have been given a trial in one of the liners recently built or now building, had there been any successful application of these to a high-speed vessel say of 1,500 to 2,000 tons displacement; but the steamship companies naturally hesitate to make radical experiments on a vessel which represents an investment of $3,000,000 more or less. We hear that 30-knot Channel steamers are under consideration by one or more of the English companies, and if such a craft be built and successfully run, we may see the speed of ocean liners make a jump of three or four knots within the next decade.

THE NATIONAL MEMORIAL BRIDGE AT WASHINGTON.

It will be remembered that as the result of a competition for a National Memorial Bridge to cross the Potomac River at Washington, the first prize was awarded to Prof. W. H. Burr, of Columbia University, N. Y., who was assisted, as to the architectural features of the designs, by Mr. Edward P. Casey. Prof. Burr presented two designs for this bridge, and the committee in awarding him the first prize decided to accept in general the engineering features of one design and the architectural features of the other. One of these designs was illustrated in the SCIENTIFIC AMERICAN of May 19. In the modified design the accepted features of the two plans are combined, and the result is an extremely dignified and beautiful structure.

The bridge may be broadly divided into the bridge proper, which consists of six 192-foot concrete and steel arches, with a bascule span of 159 feet in the center, the bascule serving to span the navigable waterway, and the three spans on either side serving to reach across the river proper. The Washington approach to the main bridge consists of twelve 60-foot semicircular concrete-steel arches and 550 feet of embankment; while on the Virginia side the approach is made up of fifteen semicircular arches of the same system of construction and 1,450 feet of embankment, the total length of the bridge including the embankments being 3,440 feet. The architectural features shown in our illustrated article above referred to have been incorporated in the new design. In the original plan, the bascule piers were surmounted by massive Roman arches, which, while they were intrinsically admirable in design, were not nearly so well adapted to the site or to the structure as the piers which are incorporated in the amended design.

The judges have decided that it would be better to provide for street car lines on the main deck of the bridge, which instead of embodying an upper and lower roadway, will be constructed with a roadway 60 feet in width, which will permit of the use of car tracks and two 12-foot sidewalks on either side of the roadway. An important modification, which greatly adds to the architectural appearance of the bridge, is the substitution of curved for straight lower chords in the bascule leaves. Good taste has been shown in adopting a flatter curve for the bascules than that employed in the three concrete spans on either side, the difference in curvature serving to emphasize the fact that the channel span is a bascule and not a permanent arch. The great arch towers at the center, and the ornamental towers at the shore abutments, will be enriched with emblematic groups of statuary and heavy bas-reliefs, which will commemorate men distinguished in the foundation and development of the Republic, the memorial bridge being intended to serve as a tribute to "American patriotism." The completion of this magnificent structure will form a notable addition to the great national monuments not merely of this country, but of the whole world, ancient and modern. The memorial will be a fitting example of the best work of the American bridge engineer in the beginning of the twentieth century, and in architectural effect it will be a worthy companion to the Congressional Library.

OUR RAILROADS AT THE CLOSE OF THE CENTURY.

In respect of its size and phenomenal growth, the stupendous railroad system of the United States is to this country what the equally stupendous British merchant marine is to the mother country. In the case of both the wonderful growth has been confined to the last three generations, and each is by far the largest in the world. We have at hand the annual statistics which are published as a part of Poor's Manual, from which it is seen that there has been a healthy growth during the past year, which, while it is far below the records of some of the years of undue expansion, is still without a contemporaneous parallel in any of the world's great railroad centers. The length of the railroads completed on December 31, 1899, was 190,833 miles, and the net increase in mileage of all railroads in the United States for the last year is given as 3,981 miles. The length of the railroads reporting traffic statistics, earnings, etc., was 186,590 miles. Upon this vast trackage there were carried about 538,000,000 passengers, and the total tons of freight transported totaled about 978,000,000 tons. The total traffic revenue was $1,336,000,000. The operating expenses were about $888,000,000, leaving net earnings of about $448,000,000, which, with $66,000,000 of "other receipts," brings up the total revenue to $513,879,443. The total payments for valuable revenue was about $411,000,000, leaving a surplus over fixed charges and miscellaneous payments of $103,000,000.

Under the head of statistics of track mileage and rolling stock equipment, some interesting figures are given regarding the percentage of steel rails in the tracks of the United States from the year 1880 to the year 1899. Thus, in 1880, when there was 116,000 miles of track, twenty-nine per cent of it was laid with steel rails. In 1885 there was 160,000 miles of track, sixty-one per cent of which was laid with steel. In 1890, when there was 208,000 miles of track (these totals including sidings and yard trackage), 80·4 per cent consisted of steel rail. In 1895 the total had risen to 235,000 miles, and the percentage of steel track to 87·8 per cent, while at close of last year, out of 250,000 miles of track, only 8·3 per cent was laid with iron rails.

The total number of locomotives has risen from 18,000 in 1880 to 37,245 at the close of 1899; the passenger and baggage cars from 17,000 to 34,000; the freight cars from 539,000 to 1,328,000. In considering these figures of increase, we must remember that the locomotives and cars themselves have increased enormously in carrying capacity, the heaviest passenger locomotive having risen in the past twenty years from 45 tons to 90 tons in weight, the freight locomotive from 60 tons to 115 tons, while the largest freight cars, from carrying a maximum load of 15 tons in 1880, have now a total capacity of 55 tons.

SODA WATER FOUNTAIN IN GREAT BRITAIN.

It would be difficult to find a more peculiarly American institution than the soda-water fountain, or one which would act as a more immediate and powerful reminder of the scenes with which he is familiar in his native land than the marble-faced, many-fauceted and nickel-resplendent structure which is one of the numerous devices by which the American citizen tempers the fierceness of the periodical "hot wave." Hence the introduction of the soda water fountain into Great Britain, as referred to in a recent report by the American consul at Birmingham, may be regarded as a notable instance of the interchange of ideas and customs between this country and Great Britain which is grow-

ing more marked every year. It seems that in a window of a "chemist shop" in Birmingham there was exhibited during the summer months a sign advertising various sodas and phosphates. The proprietor, who is quoted as "an enterprising man who is ready to try new things," has proved his fountain to be a striking success. On a hot day he sold as many as a thousand glasses of various flavors, and on other days as many as six or seven hundred glasses, and this in spite of the fact that the "doctors called and denounced the use of soda water, fearing harmful effects from the dangerous ice-cold liquid, and then took it themselves, just as they do at home." It seems that an American soda fountain syndicate has taken up the matter of these hot weather necessities in England, and a number of cities now have fountains in successful operation.

THE HEAVENS IN NOVEMBER.

BY HENRY NORRIS RUSSELL, PH.D.

The most important astronomical events of November are the annular eclipse of the sun on the 21st and the meteoric shower of the 14th.

The first of these phenomena is of little interest to Americans, since it takes place when our side of the earth is turned away from the sun. The path of annular eclipse lies chiefly in the Indian Ocean, but crosses South Africa at one end and Western Australia at the other. The duration of the annular phase is quite long, varying from five to nearly seven minutes.

There is more hope that we may see a great shower of the Leonid meteors this year; but those who, like the writer, watched in vain for them a year ago, are disposed to follow Hosea Biglow's advice, and not to prophesy unless they know. And there are several causes, any one of which, if fully operative, would prevent our seeing a conspicuous display.

In the first place, it has been shown that the orbit of that part of the meteor swarm which gave rise to the shower of 1867 has been so changed by the attraction of Jupiter and Saturn that it no longer exactly intersects that of the earth. If this change is great enough to keep even the outer parts of the meteor swarm away from the earth's orbit, there will be no more Leonid showers, unless at some future time their orbit is changed back again by some favorable planetary action. But it is by no means certain that the actual change in the orbit is as great as this.

Secondly.—The great showers of Leonids recorded in recent times were in 1799, 1833, and 1866, 1867 and 1868. Taking the middle of the last three as the main shower, the interval between showers comes out 34 years, instead of the previously supposed 33¼, and the next great shower is due in 1901, with perhaps smaller ones in 1900 and 1902.

This theory, which is due to Professor W. H. Pickering, seems to the writer of the present note to be the most probable explanation of the failure of the expected shower in 1899.

Thirdly.—Even if the shower occurs, it may be that the impressive part of it, which lasts but a few hours, may be visible only in the Eastern Hemisphere, and that we may thus miss it.

In spite of all this uncertainty, it will be well worth while to watch the sky on the nights of the 14th and 15th. For the great shower, if it does appear, will be one of the grandest of all natural phenomena, and at the same time one of sufficient rarity to make it doubly important not to lose a chance to see it.

It will be hardly worth while to start the watch before midnight, as at that hour Leo has barely risen. Unfortunately, the waning moon is in this part of the sky, and only the brighter meteors will be visible. But even so, should many of them appear, the divergence of these paths in all directions from the "radiant point" inside the sickle of Leo will be conspicuous, and will afford one of the finest natural examples of a perspective effect.

At 9 P.M. on November 15 the most brilliant part of the sky is near the eastern horizon. Just south of east is Orion. The line of his belt is almost vertical, and the still brighter stars Betelgeux (on the left) and Rigel (on the right) afford a striking contrast in color, the former being a strong red, and the latter pure white.

North of east, and also low down, is Gemini, marked by the twin stars Castor and Pollux, of nearly the first magnitude, south from which extend two lines of stars in which a little imagination sees the Twins themselves. Above Orion, Aldebaran and the Pleiades mark the position of Taurus, and to the north, over Gemini, is Capella, the brightest star of Auriga.

The great square of Pegasus is a little past the meridian. A conspicuous row of bright stars extends from its northeast corner through Andromeda and Perseus toward Auriga. The huge extent of Cetus fills most of the southeastern sky, and Aries is higher up. In the southwest the only conspicuous star is Fomalhaut. Vega and Altair are well down in the west, and Cygnus is higher up. Cassiopeia is almost above the pole, and the Dipper is opposite, skirting the northern horizon. To the right of Vega is the head of Draco, whose curving body extends for a long distance between the Great and Little Bears.

THE PLANETS.

Mercury is evening star until the 19th, when he passes inferior conjunction and becomes morning star. At this time he is very nearly in line between the earth and sun. In fact, if the conjunction took place but one day earlier, he would transit the sun's disk. He will be too near the sun throughout the month to be well seen with the naked eye.

Venus is morning star in Virgo, rising at about 3:30 A. M. on the 1st and 4:30 on the 30th. She is receding from the earth and growing fainter, but is still much the brightest object in the morning sky.

Mars is in Leo, not very far from the meteor radiant, and rises about midnight in the middle of the month, and is steadily brightening toward his opposition next February.

Jupiter is evening star in Scorpio, but is so low in the west at sunset that he will not be easy to see after the middle of the month.

Saturn is also evening star in Sagittarius, setting about an hour and a half later than Jupiter.

Uranus is in Scorpio near Jupiter, but too near the sun to be visible.

Neptune is in Taurus, invisible to the naked eye.

THE MOON.

Full moon occurs on the afternoon of the 6th, last quarter on that of the 13th, new moon at the time of the eclipse on the 21st, and first quarter near noon on the 29th. The moon is nearest the earth on the 5th and most remote on the 17th. She passes Neptune on the evening of the 8th, Mars at noon on the 14th, Venus on the evening of the 18th, Mercury on that of the 21st, Uranus on the night of the 22d, Jupiter near noon of the 23d, and Saturn on the afternoon of the 24th.

Princeton, October 19, 1900.

CONGRESS OF TRAMWAYS AT PARIS.

The International Congress of Tramways was held at Paris the 10th and 13th of September. It was organized under the auspices of the International Union of Tramways. A list of questions relating to the most important points, most of them to electric traction, had been previously sent to the members, and from the replies obtained, eleven papers or reports were prepared by leading specialists. These papers, with the discussions to which they gave rise, are of great value. The first paper, read by M. H. Géron, relates to the question of tariffs; the second, by M. de Pirch, shows the advantages of electric traction, being confined mainly to the subject of overhead systems. The results obtained have been an increase of traffic, lines and passengers; facility of extension; diminution of expenses and increase of profits, lowering of rates, etc. A paper read by M. Gunderloch shows the advantages and disadvantages of broad and narrow gages. The composition of central stations was an instructive paper by Messrs. Thonet and d'Hoop, treating of the installation of dynamos, engines and boilers. Compound engine, accumulators, and in some cases gas engines are recommended. Systems of current distribution is a paper read by M. Van Vloten, in which the usual direct current system is recommended for shorter lines, while for long lines accumulators may be used at the station. Accumulator traction may be used for lines of 9 to 12 miles. The polyphase system seems only adapted to railroads. M. Fischer-Dick read a paper upon the Falk rail-joint, and traction by accumulators was considered by Messrs. Broca and Jahannet, of the Paris traction companies, giving their experience and the deductions to be drawn for or against the system. The heating of cars was treated by M. de Burlet, who considered stoves, hot air, steam and electric heating, etc. Secondary railroad lines were considered by M. Ziffer. The methods of rating the power of dynamos and electric motors were treated by M. Macloskie. The question of brakes for tramways was considered by M. Monmerque, including the various forms of hand and mechanical brakes.

THE UNITED STATES NATIONAL MUSEUM.

The annual report of the condition and progress of the National Museum for the year ending June 30, 1898, is made by Charles D. Walcott, who has charge of the United States National Museum, and shows that the institution is in an excellent condition. During the fiscal year there were 441 accessions containing upward of 450,000 specimens. The total number of specimens recorded up to July 1, 1898, exceeds 4,000,000. The attendance during the year under consideration was less than during the previous year, owing probably to the war and the presidential inauguration, which caused a large influx of visitors. Since 1881, 3,972,987 persons have visited the museum. Prof. Walcott is of the opinion that the National Museum should be enlarged at once. The present building was erected with a view to giving the largest amount of space with the least outlay of money, and in this respect it may be considered a success. It is, in fact, scarcely more than a shadow of such a massive, dignified and well-finished building as should be the home of the great national collection. There is needed at once a spacious, absolutely fireproof building, of several stories, constructed of durable materials, well lighted, modern in equipment and on such a plan that it may be added to as occasion demands in the future. A site for such a building is already owned by the government, and only the new structure needs to be provided. The galleries just completed have added 16,000 square feet of floor space, which will help to a certain extent to relieve the crowded condition of the exhibition halls and courts below. As an illustration of the present conditions, and the necessity for more room, the anthropological collection may be cited. If the material now in possession of the government in this department should be properly placed on exhibition, it would occupy the entire space of the present museum building.

In the present structure there is a great deficiency in laboratory facilities. Curators and assistants are hampered for want of room in which to lay out, arrange, classify, mount, and label specimens. There should also be rooms in which students could bring together and compare various series of objects, and have at hand books and scientific apparatus. The quarters for storage in the present museum building are also entirely inadequate. What is needed is a series of spacious fireproof basements for the less perishable objects and equally spacious dry lofts and rooms for those collections and stores which require protection from dampness. The present museum building was built with the cheapest materials and under the cheapest system of construction, so that it gives the appearance of a temporary structure and tends to cheapen the effect of really good cases and the very valuable collections which they contain.

The head curators, curators, assistant curators and aids constituting the scientific staff of the National Museum number in all sixty-three persons and of these only twenty-six are compensated, the remainder serving gratuitously, being for the most part connected with other Bureaus of the Government. Mr. Walcott says truly that the system of honorary curatorship, while admirable within restricted limits, is a disadvantage when carried to the present extent. Such a system has a disintegrating effect upon the organization, as the men are not entirely at the command of administrative officers, and are not obliged to serve at definite hours or under the ordinary restrictions of paid curators. The number of honorary officers should be reduced by the substitution of a larger number of salaried officers.

The National Museum has at present no regular fund for the acquisition of collections, and can only make purchases from a contingent fund, which rarely exceeds $3,000 or $4,000. For this reason, every year valuable collections which should be in the hands of the government are sold abroad or to municipal museums, or pass into the hands of private citizens. The American Museum of Natural History annually expends $60,000 for the increase of its collections, and the Field Columbian Museum, in Chicago, has spent for collections during the last five years $419,000.

The floor space is far less than the American Museum of Natural History. The space on the ground floor is 140,625 square feet, and that in the gallery 16,000 square feet, and the exhibition space is 96,000 square feet. The total cost of the building was $315,400. The American Museum of Natural History, on the other hand, has 294,000 square feet of floor space, of which 196,000 is given up to exhibition space. The total cost of the American Museum to date, including the completion of the new wings, is $3,559,470, and the income for the present year is approximately $185,000. The National Museum requires buildings which will give at least 300,000 square feet of increased accommodation at once, which with the present museum space, which could be devoted to the Department of Anthropology, would make in all 400,000 square feet. With suitable buildings provided, the immediate development of the National Museum into one of the great museums of the world may be looked for.

HOW RUSSIA CORNERS SUGAR.

In an interesting article on this subject a writer in a recent Fortnightly Review says that each year the Minister of Finance fixes the amount of sugar which shall be produced in the empire and sets the price at which it shall be sold. The average domestic consumption is about 1,000,000,000 pounds. This is announced as the legal limit of production which shall be put upon the market during the year. In addition to this, it is allowed to manufacture 180,000,000 pounds more, which is placed in storage. The 1,000,000,000 pounds, as it is sold, pays an excise tax of 2½ cents a pound. If at any time through increased demand sugar becomes worth more than the price fixed by the government, the 180,000,000 pounds in reserve are allowed to reach the market free of excise duty. If this does not supply the market at the legal price, the government itself will buy from foreign countries enough sugar to supply the need for a bear influence upon the price. This has been done by Russia twice during the past ten years. This system, of course, precludes any export business in sugar, but the Russian government does not believe that the exporting of sugar from Russia can be made profitable or advisable, so it does not encourage it.

A NEW OPERATING TABLE FOR HORSES.

To subject a horse to a surgical operation has always been a task which has required the utmost skill and unremitting care of the veterinary surgeon in charge of the case. Of course, the most imperative essential toward the accomplishment of a successful operation is that the patient should be completely under the control of the surgeon, and to attain this end the animal is generally subjected to a dose of some anæsthetic. But even before this can be accomplished the animal must be secured, so that it can offer but slight opposition. Hitherto, the securing of a horse has always been a difficult matter, owing to the animal's strength and unwieldy proportions. The *modus operandi* generally employed to bring a horse to the ground is that known as casting. The animal is led to a position beside a bed of straw. His legs are then hobbled and he is thrown over sideways by sheer physical force. The objections to this process are obvious. The animal is often frightened by the sudden fall, and consequently plunges and kicks to the best of its ability, often severely injuring itself by so doing. Very often, too, bones are broken by the fall.

We present illustrations of a device which enables even the most difficult operations to be performed upon a horse with absolute safety to the animal and with the greatest ease to the surgeon. This device is the invention of Mr. J. A. W. Dollar, the well known veterinary surgeon of New Bond Street, London.

The general design of the operating table can be comprehensively gathered from our illustrations. It mainly consists of a massive iron framework of sufficient dimensions to admit a horse being placed inside. This framework, which weighs about 784 pounds, is suspended upon a central horizontal axis, so that it can be turned round in either direction as required. The two standards upon which this frame rotates are sunk into the earth and surrounded by masses of concrete weighing about five tons, so that absolute rigidity and stability of the whole structure are assured. The main body of the table consists of two powerful end-pieces of channel section connected at the top by a stout I-beam. These are connected at the sides and bottom by strong iron rods. The bars at the sides are made movable, so that they can be opened outward to admit the horse into the frame.

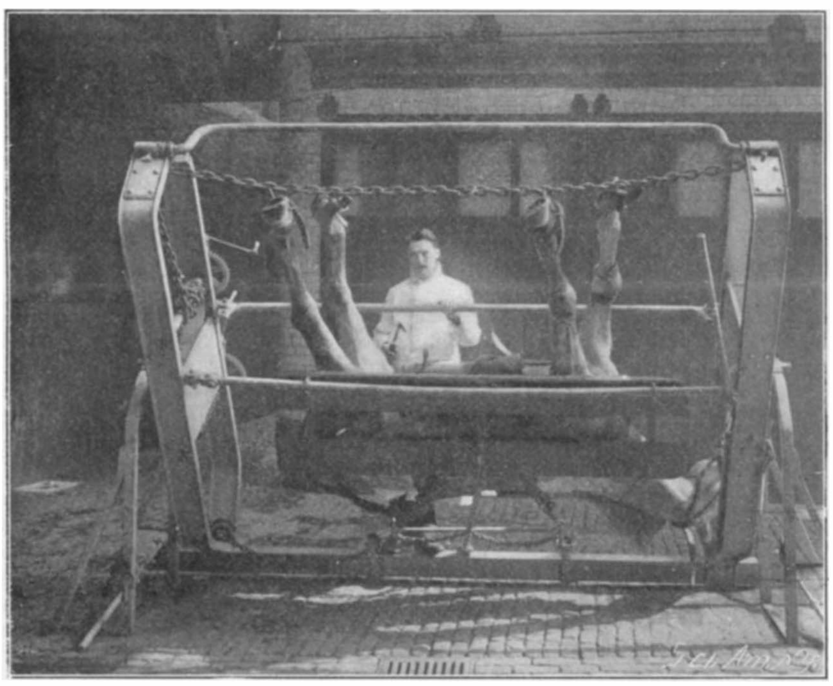


TABLE INVERTED.

The animal's head is thrust into the front end-piece of the frame, the sides of which are padded so that no injury may be inflicted. This front carries attachments for the collar ropes. On the back end-piece are adjusted the crank arms, gear wheels, etc., by which the machine and its movable parts are controlled. The swinging of the frame to any position is actuated by a lever, and so beautifully is the machine balanced that a heavy horse can be rotated with the slightest effort.

The horse before entering the frame is fitted with a strong head collar supplied with two stout cords, while round its body is securely strapped the bed-piece, a kind of broad canvas belt which is wrapped round the animal's body, the upper side of which is attached to two chains depending from a compensation bar. The side bars are firmly secured, the head fixed into the front end-piece by means of the collar straps, and the feet are hobbled to a very stout and heavy iron chain, which is attached to a gear on the back end-piece. By a slight movement of this the feet are drawn slightly apart and kept from movement.

The hanging compensation bar is so arranged that the two chains which are connected to the bed-piece on the horse are pulled vertically at both ends, so that a regular tension is given simultaneously to each chain. When the horse has been placed in the frame the winch on the back end-piece is turned, and gradually the horse is lifted a few inches off the ground. The motion is so gradual that the animal can scarcely perceive it, and should it become at all restive, its struggles are limited and ineffective. The frame is then revolved, without the slightest shock, in either direction, according to the desire of the operator. If necessary, the horse can be turned completely upside down. By means of this table every part of the horse's body is rendered accessible.

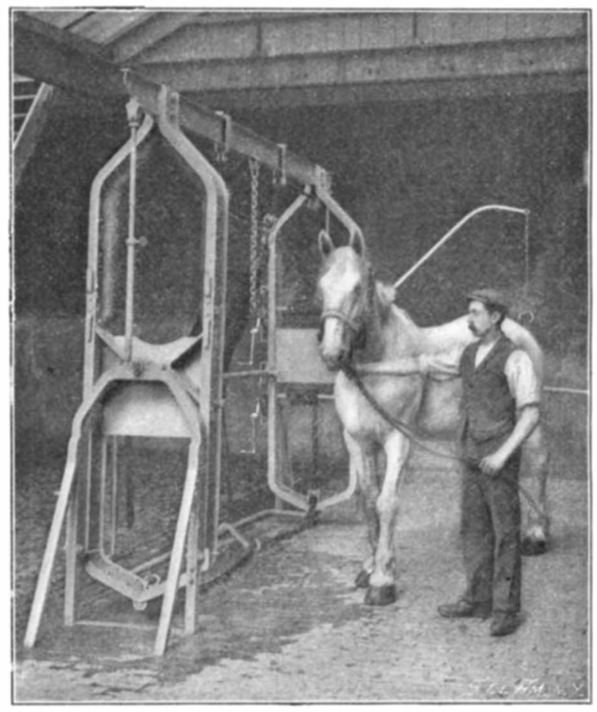
A London Railway Controlled by Americans.

A few weeks ago it was rumored in London that Mr. Charles T. Yerkes, the well-known railway magnate, had arrived in London, and proposed to intersect the whole of the metropolis with street railways, somewhat similar to those with which the principal cities of this country are equipped. The scheme was entirely discredited on all sides as absolutely impossible, owing to the fact that it would not receive Parliamentary sanction. Nothing more was heard regarding the matter from either party, but now it appears that Mr. Yerkes' scheme is no more than a revival of a railway that was projected and sanctioned by Parliament in 1893, but which, for some reason or other, was never carried out. This railway, which was designated the Charing Cross, Euston and Hampstead Railway, proposed to establish communication between the South-Eastern Railway Company's terminus at Charing Cross and that of the London and North-Western Railway at Euston, and then to proceed on to Hampstead, thus giving this suburb direct and rapid connection with the Strand and the West End. The railway, which was to be 4½ miles in total length, was to run through two tunnels, somewhat similar to that of the new electric railway. The authorized capital of the company was $8,880,000 in $50 shares and $2,960,000 in loans. From the first the scheme was unsupported. It was proposed to work it by electricity, and if it had been constructed, it would have been the first electrically equipped railway in London, but at that time the enormous possibilities of electricity as a motive power were but little known, and the majority of investors regarded the scheme as little more than the fertile conception of an imaginative brain, notwithstanding the fact that the directorate included one of the foremost electrical engineers of the country—Sir David Salomons. So affairs drifted on, and the company, although they had not started the work, still remained in existence. Mr. Yerkes was not slow to recognize the vast possibilities that lay before such a line, and how extensively it would be appreciated. The old board of directors who were controlling the original scheme retired, and a new directorate has been composed.

Operations will be soon commenced upon the work. The lines will follow somewhat in the lines of the original scheme, and it is expected, if nothing unforeseen occurs, that it will be completed in two years. The length of the railway will be increased to 6½ miles, and it is estimated that its total cost will be between $15,000,000 and $20,000,000. The engineers are Sir Douglas Fox and Mr. W. R. Galbraith. The most noticeable feature of the enterprise is that it is to be controlled entirely by American capitalists. It is probably due to this fact that it is not creating much interest among Londoners, since the Baker st. and Waterloo Railway, at present in course of construction and rapidly nearing completion, will cover somewhat the same ground, while the other scheme, described in the SCIENTIFIC AMERICAN a few weeks ago, is also receiving the support of English investors.

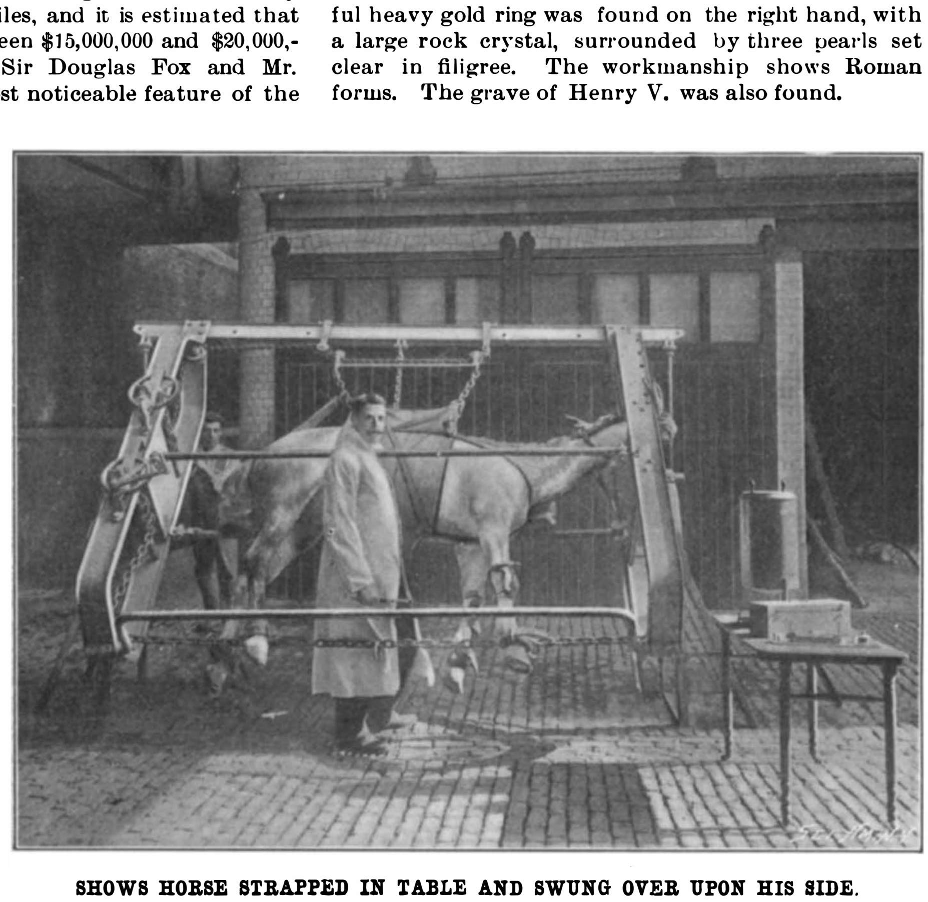
The Imperial Tombs at Speyer.

The opening of the Imperial Tombs in Speyer Cathedral, in the Bavarian Pfalz, was begun on August 17, in order to see what historical relics were left after the rifling of the tombs by the French in 1680 and at the time of the Revolution. The cathedral at Speyer was founded in 1030 and built immediately afterward. There were buried there eight German emperors—



OPERATING TABLE IN THE VERTICAL POSITION, READY TO RECEIVE THE HORSE.

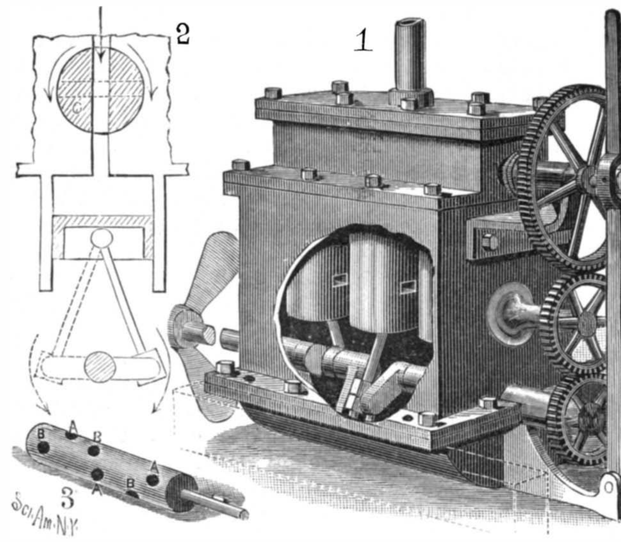
Conrad II., Henry III., Henry IV., Henry V., Rudolph of Hapsburg, Philip of Suabia, Adolph of Nassau, and Albrecht of Austria, who was murdered by Johann the parricide—and three empresses and a princess—Beatrice, the wife of the Emperor Frederick Barbarossa, with her little daughter, Agnes Gisela, the wife of Conrad II., and Bertha, the wife of Henry IV.; two bishops of Speyer, and an imperial chancellor. The definite results up to the present are the discovery of the body of the founder of the cathedral, Conrad II., and that of another emperor not yet identified. A large copper crown was at the head of each body, with a cross and three lilies in the front. The crown found with another body had the following legible inscription: "Gisilla Imperatrix R," proving the remains to be those of the wife of Conrad II. The remains of a figured cloth, with portions of gold edging, were also found. A lead tablet on the grave of the empress gives her birthday as having been on November 11, 999, which contradicts what has hitherto been believed. The bones of Adolph of Nassau are also thought to have been found. An oak casket has also been found in a large vault containing bones from various bodies and a sword. Most probably these are the bones which, after the great desecration of 1680, are known to have been collected together and buried in an oak casket in 1739. Recently another body was found in a state of decay, shrouded in a cloth. There was a copper crown with the body, which is supposed to be that of Henry III. The bones of the Emperor Henry IV. have also been found. The gilded copper crown was broken. The clothing has, unfortunately, mouldered away, except a few fragments. A beautiful heavy gold ring was found on the right hand, with a large rock crystal, surrounded by three pearls set clear in filigree. The workmanship shows Roman forms. The grave of Henry V. was also found.



SHOWS HORSE STRAPPED IN TABLE AND SWUNG OVER UPON HIS SIDE.

A REVERSIBLE ENGINE OF NOVEL FORM.

The problem of supplying a simple reversible petroleum-engine for automobiles and launches has evidently proved an inexhaustible source of perplexity to inventors, if the many motor appliances which have been devised for the purpose of dispensing with the awkward reversing-gears commonly employed be any criterion. An invention has, however, been recently



A NOVEL REVERSIBLE ENGINE.

patented by Mr. Herman B. Ogden, of 204 Carroll Street, Brooklyn, New York city, which seems to have overcome the difficulty encountered, by the provision of a simple and ingenious rotary valve. Our illustrations picture Mr. Ogden's invention applied to a three-cylinder engine in which the exhaust ports are opened and closed by reciprocating pistons, and in which the inlets are controlled by the novel valve referred to.

The inlets in question are located at the tops of the cylinders so that they can be placed in communication with a valve chamber, containing a valve, *C*, shown sectionally in Fig. 2 and in perspective in Fig. 3. The valve, it will be observed, is a cylinder formed with two sets of ports, *A* and *B*, arranged in a double spiral. When the ports are in register with the cylinder inlets, the motive agent enters the cylinders. The angles between the ports correspond with the angles at which the cranks are set, so that the cylinders are successively placed in register with a valve-port. In order to secure this successive registration, the valve is constantly turned by means of gearing (shown in Fig. 1) driven from the crank-shaft. The gearing is so arranged that the valve turns at half the speed of the crank-shaft, thereby reducing the wear.

The valve is arranged not only to rotate, but also to slide; and by means of this sliding movement the engine can be reversed. When it is desired to change the direction of the engine's motion, a shifting lever connected with the valve stem is swung over, so as to move one set of ports (*A*, for example) out of register with the cylinder-inlets, and the other set of ports (*B*) into register with the inlets, thereby causing the motive agent to act upon the crank-shaft in the opposite direction, as shown by the dotted and full lines of Fig. 2.

The inventor states that the engine is reversible at any point without danger, even though running at full speed. The motive agent may be steam, gas or compressed air. Although designed primarily for small vessels, the engine can also be used on larger ships, since any number of cylinders can be used. Since the reversing mechanism is so simple and so easily operated, the engine could be used as a steam steering-gear in larger ships and could be controlled, when thus employed, by a wheel in the pilot house. This rotary valve has a decided advantage over slide valves; for it cannot bind or clog and enables the engine to develop more power with less friction.

ELECTRIC LOCOMOTIVE AT THE PARIS EXHIBITION.

We illustrate an electric locomotive, intended for working a rack railway, as well as on smooth rails, shown at Paris by the makers, La Société Suisse, of Winterthur. The engine has been constructed for the Jourvière et Ouest-Lyonnais Railway, Lyons.

The firm has been occupied for many years in the construction of rack-railway locomotives, and has probably made the greater number of all such engines in service; they have also studied electric locomotives, and availing themselves of their experience in steam rack traction, they have already built a considerable number of electric locomotives, working on the Gornergrat, Stanstad-Engelberg, Jungfrau, Bex-Ville, and Aigle-Leysen Railways. The electric mechanism of these engines has for the most part been supplied by Brown, Boverie & Company, of Baden, Switzerland.

The engine we illustrate is one of several constructed to work the traffic of the Western Lyons Tramway Company on the steep inclines between the city and the plain of St. Just. The engine must be able to haul 28 tons up an incline of 1 in 5·2 at a minimum speed of five miles an hour. The rack is on the Abt system; current is supplied at 500 volts.

The rack mechanism is worked by a motor of 150 horse power running at 700 revolutions per minute. The motor, by means of two pinions and two spur wheels on two counter-shafts, acts on the two axles of the rack wheels. For working on the level, the carrying wheels are driven direct by two 25 horse power motors. On the rack portion of the line all three motors are worked; on the level the rack gear is, of course, thrown out of use.

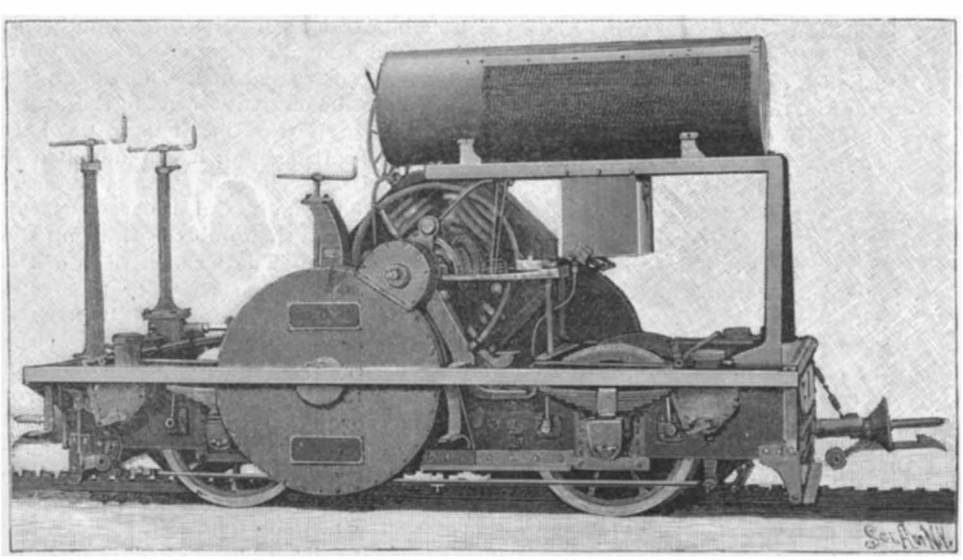
The locomotive is fitted with very powerful brakes. There are first two screw brakes independent of each other, which act on the toothed driving wheels; secondly, a similar brake acting on the carrying wheels; and, lastly, an automatic brake, which is thrown into action whenever the maximum speed allowed is exceeded, or whenever the electric current is broken by any cause whatever. The square tank, seen above the engine, is intended to carry water to keep the brakes cool.

The principal dimensions of the locomotive are as follows:

Gage..............	3 feet 3¼ inches.
Diameter of rack driving wheels..	1 " 10½ "
Carrying driving wheels..........	2 " 9½ "
Speed, miles per hour......... ..	5½
Weight of engine..	12 tons.
Total of base. ..	28 "
Revolutions per minute of adhesion motors,	300

The mechanism is inclosed in a wooden case, not seen in our engraving, provided with plate glass panes, so that the driver can at all times see it at work. The two motors for the carrying wheels are of the usual four-pole type, series-wound. They are placed between the wheels. They develop together 50 horse power when the machine is running at 9 kilometers per hour, and the torque is then not sufficient to slip the wheels.

The principal motor will work up to 200 horse power. It is shunt-wound. The armature is of copper bars, connected in series, carried in notched soft iron plates. To provide for the rough usage and high speed, the bars are very carefully secured by means of wedges of insulating material, which serve to interlock the bars with the iron plates. The motor is placed inside the vehicle, but it is not covered up, because it was deemed necessary to keep it cool, so that it has been left as open to the air as possible.



THE PARIS EXHIBITION—ELECTRIC LOCOMOTIVE.

When the train is descending the incline, the motor acts as a dynamo, generating current; this is not wasted in a resistance, but is thrown into the main circuit. In order that the tension may be raised sufficiently, more current is thrown through the shunt into the field magnets. In order that the heavy current generated may not overheat the machine, great care has been taken to maintain efficient ventilation. As the motor is shunt-wound, it automatically adjusts the current to the speed, and the speed to the current, so that the velocity of descent is very little affected by variations in the angle of inclination of the incline.

The starting and stopping arrangements are very simple. The former is effected with minimum current; all variations of speed are obtained by altering the resistance in the shunt. One small handle suffices for everything but reversing, for which a special lever is provided; this last is so connected with the regulator handle, as we may call it, that the driver can make no mistakes.

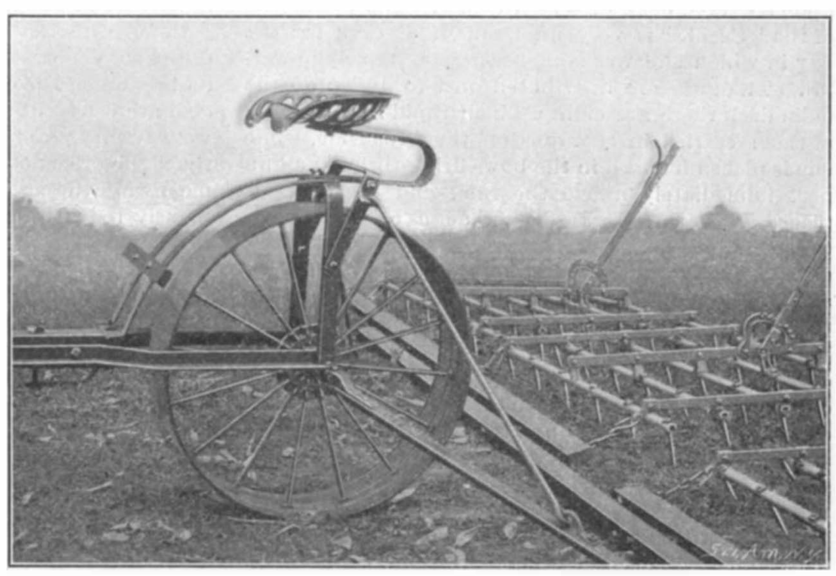
Current is taken by three "archets," or trolleys of special construction, which work when nearly horizontal or nearly vertical. This is rendered necessary by the circumstance that out in the open the line wires are some 19 feet above the level of the rails, while in the tunnels they are close to the roof of the vehicles.

The locomotive is furnished with various pieces of apparatus, such as a lightning arrester, fuses, and volt and ampere meters. A safety apparatus is provided which consists of a solenoid which carries an armature of soft iron; when this drops through failure of current, the brakes are applied and at the same time the safety switch is thrown, so that should there be a sudden return of current in the circuit, no damage may be caused by what has been termed electric momentum, which, as is but too well known, throws up the voltage enormously for a moment.

The lighting of the train is, of course, electrical.—The Engineer.

A SIMPLE SULKY ATTACHMENT FOR HARROWS.

A sulky attachment for harrows so constructed that it can be turned from side to side, as occasion may demand, without influencing the harrow is a new invention, for which patents, controlled by the Howard & Waite Company of Blunt, South Dakota, have been taken out.



THE HOWARD-WAITE SULKY ATTACHMENT FOR HARROWS.

The attachment consists of a single broad-tired wheel held in a U-hanger, to the upper portion of which a yoke is pivoted. To the lower ends of the hanger connecting-rods are pivoted which are also pivotally secured to the harrow. Braces pivotally join the connecting-rods with the yoke. It is evident that by reason of this construction the wheel can be turned to the right or to the left without moving the harrow, and that the pivotal connection of the rocking yoke with the hanger and with the connecting-rods and braces permits the harrow to ride over uneven places without interrupting the continuous action of the harrow-teeth.

The driver of the harrow takes his position over the wheel in a spring-seat. The implement can be drawn either by a team or by a single horse, with slight modifications in the structure of the forward portion of the attachment. It is evident that the invention can be applied to any harrow.

Spontaneous Combustion of Hay.

The question of the spontaneous combustion of hay has recently been investigated by one of the officials of the Weather Bureau, who states that fermentation within moist hay may raise the temperature to 374° F., at which temperature clover hay will ignite. The best preventive to spontaneous combustion is a rapid and complete ventilation by which the oxidization and fermenting substances are kept cooled down below the point of ignition.

THE FRENCH CRUISERS "CECILLE" AND "SUCHET" AT NEW YORK.

New York city has just been favored with a visit from two of the best cruisers of the French North Atlantic Squadron. The vessels anchored in the Hudson River, near Thirty-fourth Street, and attracted not a little attention from the citizens of New York, to whom the long, projecting, ram bow and the tumble-home sides of the two vessels were a forcible reminder of the notable gathering of foreign warships in our harbor in 1893 in connection with the Columbian Naval Parade. By the courtesy of Rear-Admiral Richard we are enabled to present the accompanying photographs of the vessels, the two views, which show a deck view from the bridge and one of the broadside guns, being taken aboard the Admiral's own flagship "Cecille."

These two cruisers being of the same class, but built at different periods (there being an interval of five years between them), represent to a certain extent the progress of ideas and construction in the French navy during the period 1888 to 1893. The tendency to increase the speed is seen in the fact that while the "Cecille," the earlier boat, has a speed of 19 knots, the "Suchet" is credited with 20·4 knots. It was during this period, moreover, that the rapid-fire system was introduced, and its effect is seen in the lessening of the total number of guns carried, the "Cecille" having eighteen rifles, while the "Suchet" has less than half that number. The guns of the "Cecille" originally were all of the slow-firing type, although the eight 6·4 inch guns on the main deck have now been converted to the rapid-fire system. The particulars of the two ships are as follows:

"CECILLE."—The "Cecille" is of iron and steel construction and measures 378 feet 9 inches in length over all, 49 feet 3 inches in beam and 19 feet 9 inches in draught. She is propelled by twin-screw engines of 10,200 horse power at a speed of 19 knots an hour. Her displacement is 6,053 tons, and when she is at her mean draught she carries a normal coal supply of 940 tons. Her full complement of officers and crew is 486. She is of the protected as distinguished from the armored type, reliance for keeping out projectiles being placed upon a curved deck of 4-inch armor. The armament of the "Cecille" is very numerous, and even for the day in which she was launched was extremely powerful. The guns are distributed on two decks; on the main deck there are eight 6·4 inch rapid-fire guns, six of them carried in sponsons on the broadside, while one is placed forward in the bows firing through a gun port immediately above the ram, and the other is placed aft on the quarter-deck to act as a stern chaser. On the gun deek below is arranged a powerful battery of ten 5·5-inch guns mounted in broadside. There are also six 6 pounders and fourteen machine guns, distributed on the bridges and in the fighting tops. The vessel is provided with four torpedo tubes. When the "Cecille" was launched, she carried a full set of yards on her masts and was one of the last of the French cruisers to be thus equipped; but during her reconstruction the topmasts and topgallant masts were removed and short pole masts for signaling purposes took their place. While the alteration has served to conform the "Cecille" to modern ideas, it has stripped her of much of her handsome appearance.

"SUCHET."—Although the "Suchet" is classed like her sister ship as a second-class cruiser, she is not much more than half as large. With a length of 318 feet, a beam of 43 feet 6 inches and a draught of 17 feet 6 inches, she has a displacement of 3,500 tons; she has twin-screw engines of 9,000 horse power which gave her on her trial a speed of 20·4 knots. Her normal coal supply is 480 tons, and she has a complement of 246 officers and men. The protected deck has a maximum thickness of 3 inches. Although this armor is 25 per cent less than that of the "Cecille," it is probably of equal resisting power, owing to the fact of the armor being of a five years' later date. The armament consists of four 6·4-inch guns on the deck above, one being used as a bow chaser, another as a stern chaser, and the other two being mounted in sponsons on the broadside. The "Suchet" was built at Toulon, and her design and construction may be taken as representing the best work of a modern French naval dockyard.

Anniversary of the Submarine Cable.

The 28th of August was the 50th anniversary of the first submarine cable. In 1850, upon this date, the first message was transmitted between France and England by the short section of cable laid between Dover and Cape Grisnez. The promoter of the first submarine cable was Jacob Brett, who had obtained the concession, in 1846, from King Louis Philippe. This was confirmed in 1850 and the project was carried out in three months, the constructor being the engineer Charlton Wollaston. The first cable was, however, of short duration, as the next year a Boulogne fisherman brought up a part of the cable with his nets and cut it, thinking that it was a sea-serpent. The French government then gave a new concession, and as the new submarine telegraphy had now convinced the skeptics, a company was formed in 1851 which laid a new cable; this was subsequently purchased by the English government. The first cable had a length of 25 nautical miles. The wire was the thickness of the little finger and weighed 440 pounds per mile; a series of lead weights attached every sixteenth of a mile held it in suspension at a maximum depth of 60 yards below the surface. The Birmingham factory which supplied the cable could only deliver the wire in sections of 200 yards, this being in marked contrast with the 200-mile lengths which are produced to-day. The transatlantic cable was laid at a later date.

A Seaboard Line for the Iron and Steel Carrying Trade.

BY WM. GILBERT IRWIN.

Just now the project of Pittsburg iron and steel manufacturers to build a trunk line to the Atlantic seaboard, in order to establish independent rail connections with Pittsburg, Chicago and St. Louis, is receiving serious attention in railroad circles. In the construction and highly successful operation of the new Bessemer road, the Carnegie Steel Company has given an exhibition of the possibilities along this line for the big manufacturers. Since that time there never have been any difficulties in the matter of ore transportation, and while the Carnegie Company has many advantages through the operation of their own line, other manufacturers have been able to obtain very satisfactory rates since that road has been in operation.

Just at this time the foreign markets are the object of all the big iron and steel manufacturers, and there is an unprecedented demand for our products abroad. It is in this export trade that the freight rates are felt, and in order to successfully compete with foreign manufacturers, who have so much the advantage in the way of distance, economy in the cost of shipment has become necessary. The present freight rates on iron and steel articles, such as plates, bars, channels and beams, pipe and other commodities, is $4.03 per gross ton from Pittsburg to New York. Billets are sent to the same place for $2.90 per gross ton. The manufacturers have demanded a uniform rate of $2 per gross ton, and with such concessions they have figured that they will be successful in conquering the export trade of the world. As it now is, the manufacturers of the Pittsburg district claim that they are offered large orders for export steel that they are unable to figure on because of the excessive rates to the seaboard. They claim that freight rates are higher at present than they were twenty years ago, when steel was selling for four times the price now current. They protest that in the meanwhile the cost of railroad operation has been enormously reduced, and that while the average freight rates have been reduced the charges from Pittsburg are higher than they were many years ago. In fact, they claim an unjust discrimination against Pittsburg.

The Pittsburg manufacturers assert that steel is no harder to handle than other commodities, that the cars are loaded to their full capacity. They claim that it costs more to build a box car to haul grain than it does to construct a gondola to carry steel, and that when a grain car is wrecked it means a loss of $1,500, while in the case of a car of steel the product can be placed in another car and hurried to its destination. It is also pointed out by the Pittsburg manufacturers that the rate from Buffalo to New York by the Erie Canal is only five cents per hundred, while that from Cleveland is only three cents more. Some Pittsburg exporters, by taking advantage of the roundabout way and paying the local rate of eleven and a half cents from Pittsburg to Buffalo, have been able to save one and one-half cents per hundred over what they would be required to pay on a direct all-rail haul to the sea coast. The regular summer rate was withheld this summer, in which fact the manufacturers have another cause for complaint. Summer rates have been customarily granted by the railroads in order to secure the trade of lake cities in competition with low-priced water hauls, and also to protect the shipper in the districts in which no water transportation is available.

Another reason given by the manufacturers why rates to the seaboard should be low is the high ocean rates now in force. The heavy inroads made on the merchant marine, first by the English government to secure transports for the Boer war and now the heavy demands made by the Powers for use or reserve in China, have taken many vessels out of the service from New York, Philadephia, Baltimore and Boston to European ports. It is also pointed out that five years ago, when steel was selling for twice the figure now received, the rates were only $2.40 per gross ton. It is the claim of the manufacturers, and seemingly a just one, that Pittsburg above all other cities needs the fostering influence and protection of the railroads. Fuel is yearly, owing to the progress of engineering science, becoming less important, and its costs are being yearly reduced by invention and improved methods.

In view of these conditions there have been several conferences between the manufacturers and the traffic managers, and as a result the manufacturers have come to the belief that no aid will be extended to them. At a joint meeting held last month, the representatives of Pittsburg manufacturing concerns which pay an aggregate of $100,000,000 were present. The result was far from satisfactory, and now Pittsburg manufacturers can see relief only in a great trunk line from Pittsburg to the seaboard with western connections. They have estimated that $30,000,000 will easily build all the trackage needed, and this sum only represents five per cent of the $600,000,000 invested in Pittsburg industrial concerns.

The manufacturers seem to agree that the Philadelphia & Reading, which has terminal facilities in Philadelphia superior to the Pennsylvania or B. & O., is the line to make the nucleus for the seaboard line. The plans are to use the Bessemer & Lake Erie road of the Carnegie Company to a point near Unity, where the old Calvin Brice system crossed the Bessemer line. From this point the new line would follow a natural divide up the Kiskiminetas and across the country to Mehaffey. The west branch of the Susquehanna would then be followed to Williamsport, where the Philadelphia & Reading road would be reached. The line to be thus built would have a length of one hundred and sixty miles and would cost about $50,000 per mile, or between $8,000,000 and $10,000,000 for the great link. The plans of the manufacturers would be to obtain possession of the new road now being built up the west branch of the Susquehanna. The average grade of this line would be below one per cent. The Union road of the Carnegie Company, the Monongahela connecting road of Jones & Laughlin, the McKeesport connecting road and other lines about Pittsburg would make a complete terminal chain of the Monongahela Valley, and a system of boat lighterage on the rivers would give a most comprehensive and perfect terminal in Pittsburg.

Just now the Lake Erie and Ohio River Ship Canal, which is to connect Pittsburg with Lake Erie, is receiving much attention. The American Steel and Wire Company is constructing a line of boats which will be used on the Great Lakes during the summer as ore carriers, and in the fall they will be sent across the Atlantic with steel for Europe and will be used regularly in the export trade on the Atlantic during the winter. With the construction of the canal, it will be possible for two or three thousand ton boats to make the trip to Europe by the Great Lakes, and thus the question of freight on foreign shipments from the mills of Pittsburg would be solved. But just now the matter of securing independent rail connections with the seaboard is the question uppermost in the minds of Pittsburg manufacturers, and the near future is certain to see some interesting developments in railroad affairs so far as Pittsburg is concerned.

Automobile News.

The Cooke Locomotive Works, of Paterson, N. J., have just finished a heavy motor wagon on the Thornycroft plan.

An interesting automobile suit was tried at Hackensack, N. J., where J. L. Guyre sued Dr. W. L. Vroom, of Ridgewood, for damages from a runaway, said to have been caused by the latter's automobile, and resulting in the death of the plaintiff's wife, says The Western Electrician. Dr. Vroom's testimony was that the horse was frightened and turned when 275 feet away from the automobile, which he stopped upon seeing that the animal was afraid. He said that he had the machine under perfect control, and gave an exhibition in front of the court-house to show the court and jury his ability to handle it. During the trial Justice Dixon said: "If the automobile occasionally or exceptionally frightens horses, that would not make it a nuisance. In order to make it a nuisance, its common effect must substantially interfere with the people who drive horses along the highway." After being out a few minutes the jury returned for further instructions on one point, at the same time informing the court that it had agreed that the automobile was not a nuisance.

A large English constructor, J. Fowler, of Leeds, has recently furnished to the British government an armored automobile train, consisting of a number of cars towed by a road locomotive. This is the first of a series which is to be constructed upon the same principle; it will no doubt be of great service in the army. The first train has been tried in England not long since, and has proved satisfactory; it can mount a 10 per cent grade when heavily loaded. The engine carries a windlass mounted upon it, and, if necessary, can mount the grade alone and then pull the train up the grade by means of a rope. The locomotive is of the usual road-engine type; it draws three or four cars. Both locomotive and cars are protected by special plates to resist balls or bursting shells. Each of the cars is arranged to carry a howitzer or a machine gun of about 3 inches, or to transport men, ammunition, or provisions. The armor plating is built separately and may be taken off in sections to allow inspection or repairs. The speed is from 2 to 6 miles per hour. The locomotive has a set of transmission gearing by which three different speeds may be obtained. The water reservoir has sufficient capacity for a distance of 10 to 15 miles. The engineer is well protected and has at hand all the levers and valves for operating.

Science Notes.

A new diamond field has been found forty-two miles from Griquatown in Cape Colony.

There has been a third trial of Zeppelin's airship, which took place on October 21. It ascended at five o'clock in the afternoon, and after rising 900 feet it described a circle and then moved to the eastward and performed various evolutions to show that it was under full control. It then turned and went three miles to the south and afterward returned and descended. There was not the slightest hitch during the trial.

It has been considered until recently that it was almost impossible to produce cheese from pasteurized milk, but a short time ago a chemist of Stockholm succeeded in effecting a preparation that solved the difficulties. Owing to this discovery, the product of which has been named "caseol," palatable and nourishing cheese, free of tubercular bacili, can now be made from pasteurized skimmed milk. This preparation has, moreover, the excellent quality of rendering cheese more digestible. Several dairies in London have made experiments with "caseol" with the same favorable result.

Mr. Evelyn B. Baldwin is making preparations for a Polar expedition, the objective point being, of course, the North Pole. He is being backed in his enterprise by Mr. William Ziegler, of New York. The expedition will start next summer, and it is expected that two ships will be equipped in order that one might remain behind while the other returns south for fresh supplies. By this plan the ship remaining in the Arctic could be used for headquarters of land expeditions. It is probable that the vessels will be specially constructed like the "Fram." Mr. Baldwin was with the Peary expedition of 1893–94, and spent the winter of 1898–99 in Franz Josef Land, as a member of the Wellman expedition.

The selection of names for the Hall of Fame on University Heights, New York city, includes a number of inventors and scientists. Among them are Benjamin Franklin, Robert Fulton, S. F. B. Morse, Eli Whitney, Peter Cooper, Elias Howe (?) Asa Gray, etc. There were ninety-seven judges, and the names given are from the first thirty. The order of precedence and the full list was as follows: George Washington, Abraham Lincoln, Daniel Webster, Benjamin Franklin, Ulysses S. Grant, John Marshall, Thomas Jefferson, Ralph Waldo Emerson, Henry W. Longfellow, Robert Fulton, Washington Irving, Jonathan Edwards, Samuel F. B. Morse, David G. Farragut, Henry Clay, George Peabody, Nathaniel Hawthorne, Robert E. Lee, Peter Cooper, Horace Mann, Eli Whitney, Henry Ward Beecher, James Kent, Joseph Story, John Adams, William Ellery Channing, John J. Audubon, Elias Howe (?) Gilbert Stuart, Asa Gray.

The problem of supplying ink wells for schools, insurance offices, banks, etc., is much more complicated than might be at first supposed. If each employe fill his own ink well, bottles of ink are broken, disfiguring property. A writer in Science and Industry describes an ingenious plan for distributing ink. It consists of a wooden carrier with four partitions, a handle and two little projecting shelves for supporting the inkstands. Three bottles of ink are put in the carrier, and a large tumbler is put in the fourth space to take the dregs. Each bottle has a combination stopper and pump, which consists of a rubber bulb attached to the stopper. When the bulb is pressed, the air forces the ink up through the tube and ejects it into the ink-well. The ink never drops from the nozzle after filling the inkstands, for the moment the hand is removed, the ink in the nozzle and tube drains back to the bottle, air being sucked in through the nozzle to take its place. Red, black, and copying ink is regularly kept in the carrier.

The new National Museum at Munich is one of the most interesting in Europe. The problem of arrangement was a most complicated one, and the difficulties have been solved in an admirable manner. The building cost about a million dollars, and contains a hundred rooms. The objects are shown, as they should be, in comparatively small galleries. The leading principle is that the ground floor should show, in strict chronological order, Bavarian life of different epochs, from the little circular room which in its architecture and its contents recalls the tenth and earlier centuries down to the blue and gold magnificence of the late King Louis. In the earlier rooms the sense of architectural evolution is greatly helped by the fact that the various castles of the Bavarian crown have contributed ceilings, windows, wainscots, etc., and in some cases the rooms have been planned specially to receive these. The museum contains an almost endless number of specimens, large and small, of domestic art of the country in all ages; of wardrobes, caskets, iron utensils, beds, tables and chairs, the supply seems inexhaustible, and nearly all of them are in their original state. The Bavarian Museum neglects nothing which is of any historical interest, and is, in consequence, one of the most complete of its kind to be found in Europe.

Engineering Notes.

Glass factories in Germany now number 400, and the works give employment to 35,000 men.

The new waiting room of the Grand Central station has been opened to the public, and it is one of the finest rooms of the kind in the country.

The great Galerie des Machines is to be cleared away after the Paris Exposition. It is so large that it cannot be readily utilized for exhibition or other purposes.

A spiral chimney, 150 feet high, has been built near Bradford, England. The chimney is square in cross-section, and each layer of brick is shifted three-sixteenths of an inch out of place, thus giving a peculiar twist to each side of the stack.

The Gas Committee of the Manchester City Council, England, has appointed a special subcommittee to consider and report as to the desirability of recommending the council to purchase a coal mine. Nearly 500,000 tons of coal or cannel are annually carbonized at the corporation's gas works, and an advance of $1.25 per ton on the new contracts would entail an increased annual outlay for the raw material of gas manufacture of $500,000 for the current year.

The General Society of Mechanics and Tradesmen of New York city has added to its library a department of trade catalogues. These will be indexed and filed away and will be accessible at all times to those who wish to consult them. This is an excellent idea, and all public libraries should do the same, as the information which is frequently given in trade catalogues is of the utmost importance and represents the very latest practice, which cannot be obtained elsewhere.

The railroad bridge at Galveston has been restored, the work being completed twelve days after the storm. It was 2½ miles long, and most of the piles were found standing, says The Railroad Gazette, except at the draw opening, and where a large vessel was blown against the bridge in a storm. Considerable of the material for the new caps and flooring of the bridge had to be delivered on rafts, the track and roadbed having been destroyed for about 8 miles north of the terminus of the railroad at the bay.

A clever engineering feat has recently been accomplished at the Agecroft coal mine, not far from Manchester. This colliery is the second deepest in England, the shaft extending to a perpendicular depth of 2,175 feet. During the erection of the necessary machinery, three immense boilers were lowered down the shaft in a complete condition. This is the first occasion upon which boilers have been installed in this manner, since previously they have always been sent down the mine in pieces and then fitted together.

According to a German contemporary, artificial slate is tin-plate coated with a mixture of finely ground natural slate, lampblack, and a solution of water glass. The soluble glass solution is prepared by finely powdering 1 part by weight of solid potash water glass and 1 part of soda water glass in a mortar and pouring over this 12 parts of soft or distilled water; after boiling 90 minutes, the water glass dissolves completely. Seven parts of slate ground with water to an impalpable pulp are mixed with 1 part of lampblack and added to the water glass solution; the rather stiff mass which results is brushed upon tin plates previously roughened with sandstone.

A diamond circular saw for cutting stone is described in London Engineering, and is said to cut hard sandstone blocks at the rate of five feet per minute. The saw has dovetailed recesses in which are fitted steel blocks, each containing a diamond. A hole is drilled into the block, but stopped before running through. A diamond is dropped into the hole, and a steel wire peg driven in behind it. The block is then put in an electric welding machine, and when it is softened, pressure is applied until the diamond is firmly gripped and the steel peg is welded into place. The front of the block is then filed away until the diamond is exposed, and the sides are milled to fit the dovetailed recesses in the saw. The positions of the diamonds in the blocks vary, so as to enable the saw to clear itself in making the cut.

The Swedish State Railways have recently placed a steam ferry at Copenhagen for the purpose of carrying on the trade between that port and Malmo. The vessel has been constructed at the Kockum Shipyard at Malmo and cost $250,000. The boat is a screw steamer 268 feet in length by 52½ feet beam, and is capable of steaming 13¼ knots per hour. The vessel is built of steel, and is an ice breaker, so that she may be able to force her way through the heavy and thick ice floes with which the channel is covered during the winter. The displacement of the boat when loaded with 18 railway cars is 1,600 tons, while she has accommodation for 900 passengers. There is an extensive deck, 150 feet by 46 feet broad, amidships. The vessel is illuminated with electric light throughout, and comfortably appointed. Should this vessel prove successful, several other similar type of craft will doubtless be placed upon this service, in order to deal with the rapidly developing traffic between these two places.

Electrical Notes.

A telegraph line has been completed between Seattle, Washington, and Skagway, Alaska.

Some experiments have been conducted at St. Paul, in which electricity at a pressure of 30,200 volts was sent through an underground cable three miles long. The highest voltage formerly obtained was 20,000. The cable consists of three copper conductors, each being inclosed in a paper tube, the whole incased in lead and drawn through vitrified conduits. The cable is a part of the system by which the gas light and power company will utilize the water power of Apple River, Wis., the other 24 miles of wire being overhead.

An electrically operated interlocking switch and signal plant is to be installed at Sixteenth and Clark Streets, Chicago. Electric motors and solenoids will be used for switches and signals. The semaphores will be operated by electric motors of ⅛ horse power, while the dwarf switch signals will be worked by solenoids. The switches will be thrown by one horse power motors. The system is said to work particularly well, as bad weather has less effect upon this system than it has upon mechanical or electro-pneumatic operated plants.

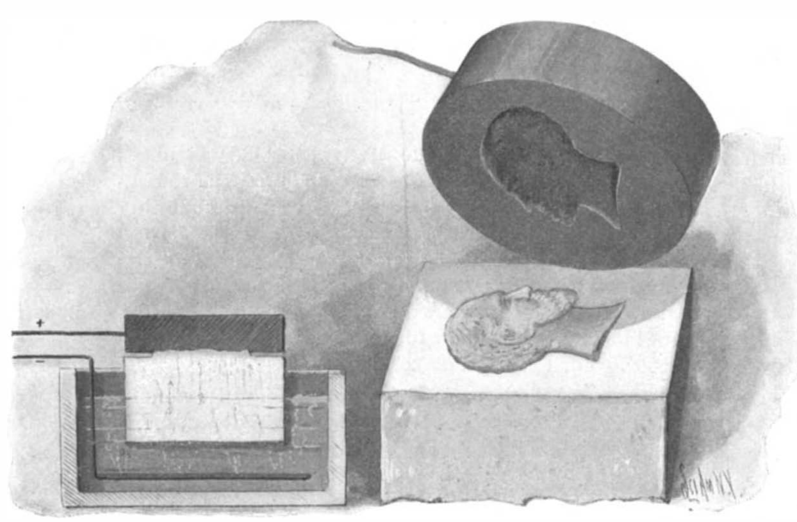
Marconi has made many new improvements in wireless telegraphy, and has now done away with the masts in certain of his experiments. He began as long ago as last January work on the cylinder plan, and he has already telegraphed 60 miles with a cylinder 4 feet high, instead of a mast and wire 125 feet high. The essential arrangement in working the cylinder plan is not greatly different from that of the aerial wire. The transmitting instruments are practically the same, a battery, induction coil, earth wire, etc., being used. The only change in this part of the apparatus is the introduction of resistance coils where needed, and an arrangement for sending "tuned" messages. The cylinder rests upon a table. Marconi has devised methods by which a number of installations may be worked together in the same room or building.

When a battery of cells is used as a source of electric energy, the constant element in the circuit is the E.M.F., while the current depends upon a variety of external conditions. The case is reversed on using an influence machine driven at a constant speed, for then the mean current is the constant element, while the E.M.F. is a dependent variable. This fact has been utilized by M. Toepler for investigating the continuous discharge in air at atmospheric pressure as dependent upon the current. This continuous discharge may appear in four different forms, viz., glow, brush, brush arc, flame arc. All of these may appear both at the positive and negative electrodes, but to simplify matters the author takes care nearly to suppress the effects at one electrode by covering it with a flat bad conductor such as a slate. He is thus enabled to study the effects at the two electrodes independently. As a general rule, an increase in the current strength brings about a transition from the glow to the brush, and finally to the brush arc. But this transition is not continuous unless the capacity in the circuit is negligible. Otherwise the three continuous stages are separated by stages of discontinuous spark discharge; and as the capacity increases, the discontinuous stages encroach until the brush arc is almost entirely eliminated. Finally, the author deals at length with two forms of natural continuous discharge, viz., St. Elmo's fire and globular lightning.—M. Toepler, Ann. der Physik, No. 7, 1900.

There has just been introduced in the East End of London an enterprising system of selling electric light. The districts embodied are Poplar, Bromley and Bow, three of the busiest and most thickly populated localities in London, inhabited by the artisan class. The streets in this part of the metropolis have always been poorly lighted, but now they have been supplanted by large electric arc lamps. Altogether 195 arc lamps have been installed throughout ten miles of streets, but this is to be increased in the immediate future. The light is to be supplied to the inhabitants at such a low price that it will be cheaper for the working classes to avail themselves of electricity than the gas for lighting purposes. Then, again, the light is to be installed in the dwellings free of cost to the residents, so that actually the tenants have only to pay for the amount of electricity consumed. This scheme was first projected so far back as 1893. The tariff for consuming the light is extremely moderate and should recommend the universal utilization of this cleaner, cooler, and more efficient illuminant. For light consumption it will be supplied at 6 cents, 8 cents and 10 cents per unit, while for motive power it will be supplied at the purely nominal costs of 3 cents and 6 cents per unit. The present cost of the gas is 68 cents per 1,000 feet, and as about 5 units of electricity is equivalent to 1,000 feet of gas, there is a considerable difference between the cost of the gas and the electricity. When the installation has been completed, 65 miles of streets will be lighted by the electric lamps, and the houses corresponding to the same area of streets will be in a position to avail themselves of the electric light. The installation has cost about $500 000

THE RIEDER ELECTRO-ENGRAVING APPARATUS.

On the first story of the Gallery of Machines of the Exposition there may be seen, in the German section, the first specimen of a very curious apparatus invented by Herr J. Rieder, of Leipzig. It is a machine that permits of electrically sinking the steel dies employed for striking medals and coins or embossing sheet metal, leather, or cardboard. With the ordinary processes, the production of such dies requires special skill on the part of the artisan, and their net cost is consequently very high. So, for a long time, there has been sought a mechanical process of manufacture that should do away with, or at least reduce the manual labor. The object of Herr Rieder's apparatus is to solve the problem by effecting the progressive corrosion of a plate of steel through electrolysis, that is to say, through the action of an electro-chemical bath.



METHOD OF ELECTRO-ENGRAVING AND SAMPLE OF WORK.

The principle of the operation is represented in the diagram given in the accompanying figure.

The block of plaster (Gipsblock), bearing at its upper part a raised impression of the figure to be reproduced, is half immersed in a solution of chloride of ammonium. Upon the relief of the block of plaster is placed the steel plate (Stahlanode) that it is desired to engrave. This plate is connected with the positive pole of a source of electricity, and consequently constitutes what is called the anode. The negative pole, or cathode, consists of a sheet of copper immersed in the solution and arranged beneath the block of plaster. The electric circuit is closed through the intermedium of the bath of chloride (electrolyte), which, as a consequence of the porosity of the plaster, soon ascends through capillarity to the steel plate. As soon as the current is turned on, the chloride is decomposed, and the chlorine that is set free attacks the steel plate at the points where it is in contact with the plaster relief. The chloride of iron thus formed is dissolved and the plate is gradually hollowed out. Other points of the relief come successively into contact with the metal, and there is finally obtained a steel mould of the plaster model.

We shall not enter into the details of all the difficulties met with by Herr Rieder in the application of this ingenious process and which he had to surmount in order to reach the remarkable results obtained with his apparatus. It will suffice for us to make known the principle of it. The first experiments showed that the steel to be engraved must not be applied to the model permanently, since the insoluble substances, such as carbon, contained in the metal deposit in the form of a black adherent powder that must be periodically removed. To this effect, there is given to the apparatus a to and fro motion that separates the steel from the block of plaster every twelve seconds and replaces it, after the cleaning (which is likewise automatic), in the mathematically exact position that it previously occupied.

With the Rieder apparatus, the engraving of an 8×12 inch steel plate requires about fifteen hours, while it often takes more than a month to do the same work by hand.

The apparatus permits of the reproduction of any model of plastic material, such as wax, plaster or wood, and preserves in the mould, with absolute fidelity, the most delicate details created by the hand of the artist.

At the Exposition, the operation of the apparatus is entirely electric, the machine being actuated by a motor that receives the current from the general distribution of electricity.

Let us add that since the surveillance of the automatic operation is very simple, it is possible for one man to run several apparatus at once, and thereby effect a great saving in manual labor.

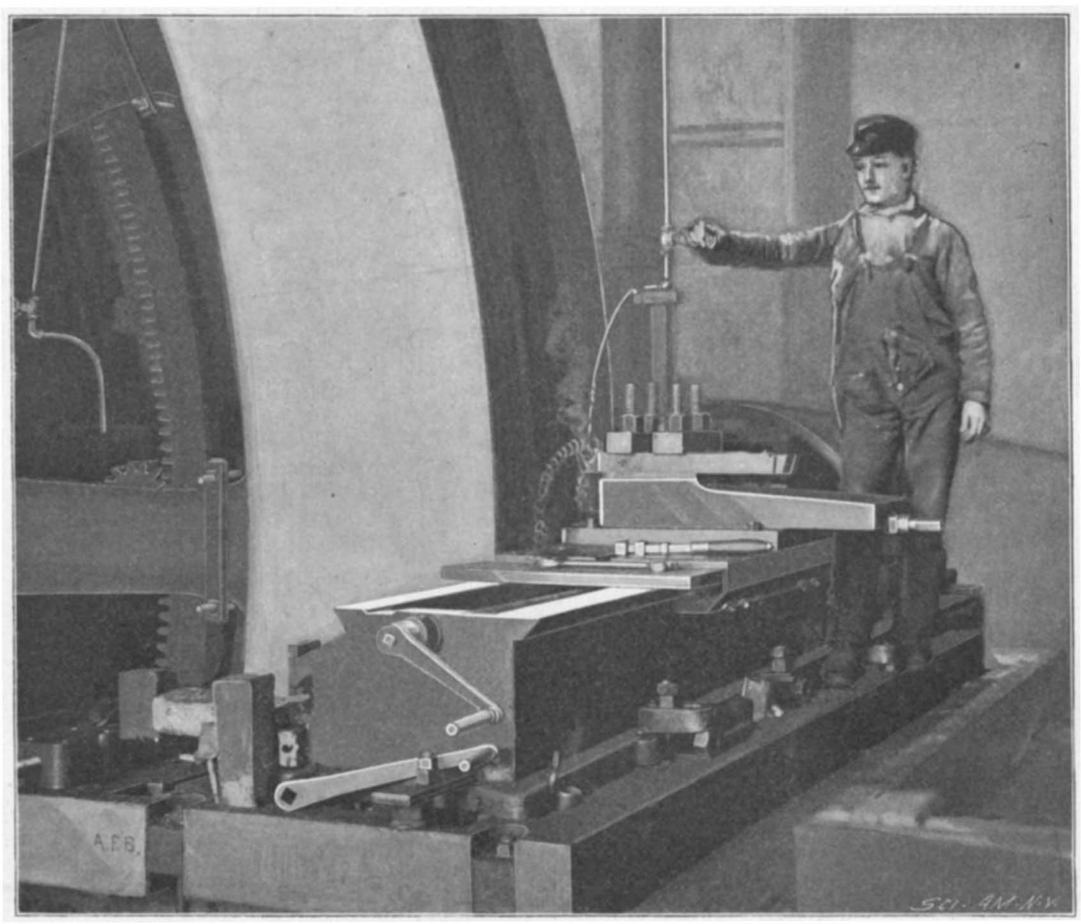
After the operation is finished, it requires but a few retouches executed by the hand of an engraver to remove all the traces left by the plaster model.

The field of the applications of this process is very vast, since it embraces all the industries that manufacture ornaments obtained by stamping, and, in the first rank, the cardboard, leather and metal industries.—L'Illustration.

THE CONSTRUCTION OF A 150-TON FLYWHEEL.

We have already in a previous issue given a description of the great power house at Ninety-sixth Street and the East River, New York city; and it will be sufficient to merely state a few of the leading features of this most remarkable installation, before describing the construction of the huge flywheels, one of which forms the subject of the accompanying illustration.

The power plant, which occupies an imposing structure measuring 279 feet by 200 feet, consists of forty-eight boilers of the Babcock & Wilcox type, and eleven Allis vertical cross-compound condensing direct-connected engines, which have a capacity at 50 per cent overload of 6,600 horse power each, making a total capacity for the whole engine room of about 70,000 horse power. The engines are set up in two parallel rows, which extend the full length of the engine room, one row containing five units and the other six. The high-pressure cylinders are 46 inches in diameter, the low-pressure 86, and the common stroke is 60 inches. The engines are run ordinarily at a speed of 75 revolutions per minute, at which the piston speed is 750 feet per minute. All the wearing parts are of very liberal proportions. Thus, the main bearings are 34 inches in diameter by 66 inches in length, and the crossheads and crank pins measure 14 by 14 inches. Each engine is direct-connected to a three-phase generator whose normal capacity is 3,500 kilowatts. Current is transmitted to the substations at a pressure of 6,600 volts. Between the engine and the generator is a massive flywheel weighing 150 tons.



TURNING THE RIM OF A 150-TON FLYWHEEL.

On account of their great size and weight, considerable interest attaches to these flywheels, and there are certain novel features in their construction and the way in which the massive rims were built up and finally trued up to form. Each wheel was cast in ten sections, each section consisting of an arm and a rim. The arms are bolted to the hubs, and the rim segments are connected by heavy links of steel, 5 inches deep by 10 inches wide, which were shrunk on in suitable recesses formed in the rim. After the wheel was erected, the cast steel rim, which is 29 inches in depth by 10 inches in width, was widened out by building up on each side of it eight circles of 1⅛-inch steel plates which were riveted on with 3-inch steel rivets. When the riveting was complete, the rim was in a necessarily rough condition, and it was turned to shape by means of a special lathe driven by a portable electric motor. A heavy bed plate (see engraving), which surrounded the rim on three sides, was bolted to the floor of the engine room. On this was placed a lathe-carriage and tool-rest. The rest carried two tools placed side by side, the firs of which took off the roughing cut and the other the finishing cut. The flywheel was rotated by means of a large segmental spurwheel, which was clamped to the arms of the wheel, and a pinion mounted directly on the shaft of a portable electric motor. After the rim had been turned on both faces and the periphery, it was polished with a big emery block.

The arrangement worked satisfactorily, and the perfect truth with which these huge wheels are now running is one of the attractive features of these very imposing and handsome engines.

A Substitute for the Term "Indian."

There is no satisfactory denotive term in use to designate the aboriginal tribes of America. Most biologists and many ethnologists employ the term "American;" but this is inappropriate, since it connotes, and is commonly used for, the present predominantly Caucasian population.

The term "Indian," first used (in the Spanish form "indio") by Columbus, in the belief that the lands which he had discovered in the West were on the confines of India, in Asia, is universally used in popular speech and writing, and to some extent in ethnological literature, but is objectionable in that it perpetuates an error, and that it connotes, and so confuses, distinct peoples. Such an error was excusable at the time at which it originated, but there is no reason for its continuance, and it evidently would be well if the term "Indian" could be supplanted by some appropriate scientific designation.

During a discussion of the subject at a meeting of the American Anthropological Society on May 23 of last year, Major J. W. Powell advocated the use of the name "Amerind," an arbitrary compound of the leading syllables of the frequently used phrase "American Indian." The proposed term carries no implication of classific relation, raises no mooted question as to the origin or distribution of races, and perpetuates no obsolete ideas. So far as the facts and theories of ethnologists are concerned, it is purely denotive. The term is sufficiently brief and euphonious for all practical purposes, not only in English, but also in the languages of Continental Europe. It may be readily pluralized in these languages, in accordance with their respective rules, without losing its distinctive sematic character. Moreover, it readily lends itself to adjectival termination in two forms, viz., "Amerindian" and "Amerindic," and is susceptible also of adverbial termination; while it can be readily used in the requisite actional form "Amerindize," or in relational forms, such as "post-Amerindian."

The term is proposed as a designation for all the aboriginal tribes of the American continent and adjacent islands, including the Eskimo.

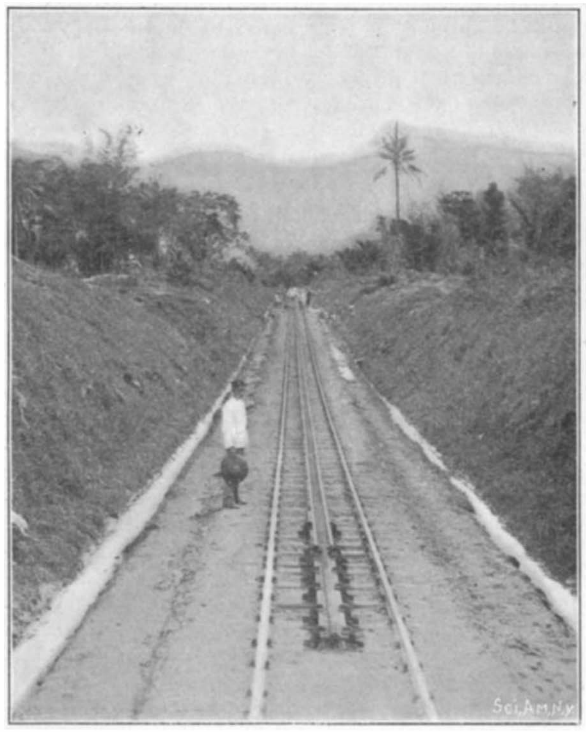
The working ethnologists in the society were practically unanimous in approving the term for tentative adoption, and for commendation to fellow students in this and other countries. As the working specialists form the court of last resort, it cannot be doubted that any term acceptable to them may be expected to come into use with considerable rapidity, and be eventually adopted by thinkers along other lines.

THE experiments which have been carried on by the South Metropolitan Gas Company with American coal are proving to be very satisfactory, and it is superior to the best English gas coal. It is found to be freer from sulphur and more easily purified. The cost of the American coal is, however, much higher, being $8 a ton on board ship, and the freight is $4.

A RACK RAILWAY ON THE ISLAND OF SUMATRA.

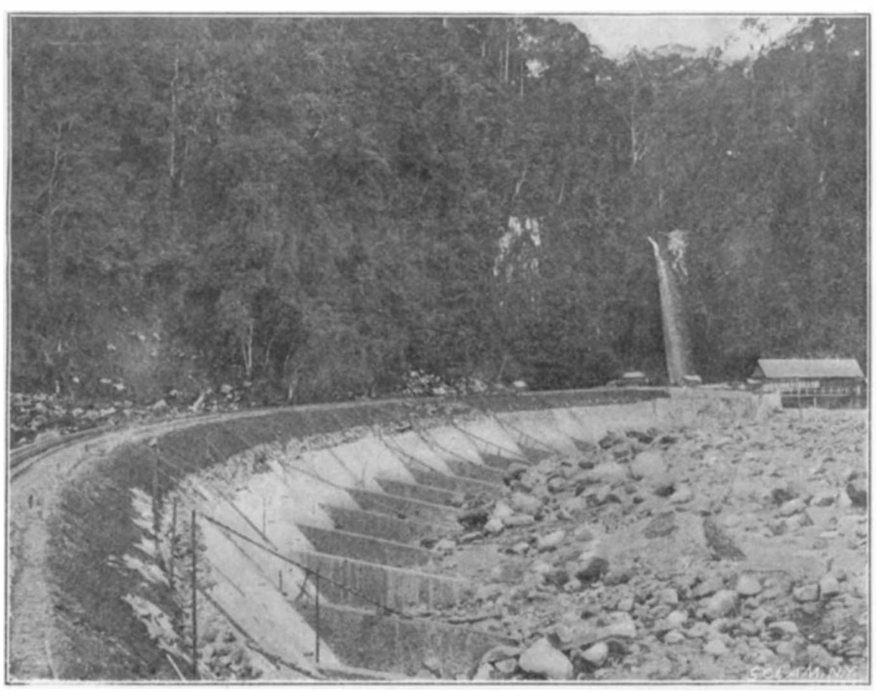
The island of Sumatra, in the Dutch East Indies, is the only country in Southeast Asia which possesses a rack railway. This line is the more peculiar as it does not serve for passenger traffic, but almost exclusively for the transportation of bituminous coal. At present about 25,000 tons of coal are carried over the line annually. The capacity of this railway could, however, be considerably increased; it is now only operated during the daytime, but in spite of this limited traffic, the line has greatly contributed to the development of the Dutch East Indian colonies.

Thirty-five years ago the Dutch engineer, De Greve, discovered rich and extensive deposits of bituminous coal in the mountainous interior of Sumatra. The distance from these deposits to the coast amounted to only 60 kilometers, but the tract was crossed by high mountains, the chain of Barissan, acting as a barrier to transportation. On account of this drawback, the exploitation of the coal deposits was long delayed. It was only in 1887 that the Netherlands Parliament decided upon the construction of a railway to connect the coal field with the great port of Padang, on the southwest coast of Sumatra. Branch lines were at the same time contemplated to Fort de Kock, to Payacombo, and to the coal fields of Lounto. The first part of the railway was completed in 1891, and the rest in 1896. The total length of all lines with their branches amounts to 130 miles, of which 97 form the main line, and of this no less than 36 kilometers (22·37 miles) are of the cogged-wheel type. The greatest incline is 1:12·5, and the diameter of the smallest curve 150 meters. The railway reaches its highest between two volcanoes in the neighborhood of Fort de Kock, 1,154 meters (3,786 feet) above the level of the sea. Tunnels occur only at two places: one, 70 meters in length, in the valley of Anei, with rack track, and the other one, 826 meters long, with ordinary track. The great inclines which are to be overcome by the railway necessitated at some places the erection of special structures; thus, for instance, of an arch bridge of a span of 59 meters, with an incline of 68 milimeters per meter. The work on the line was carried out by natives of Sumatra and Java, and only for the heaviest work Chinese laborers and some 500 convicts were employed.

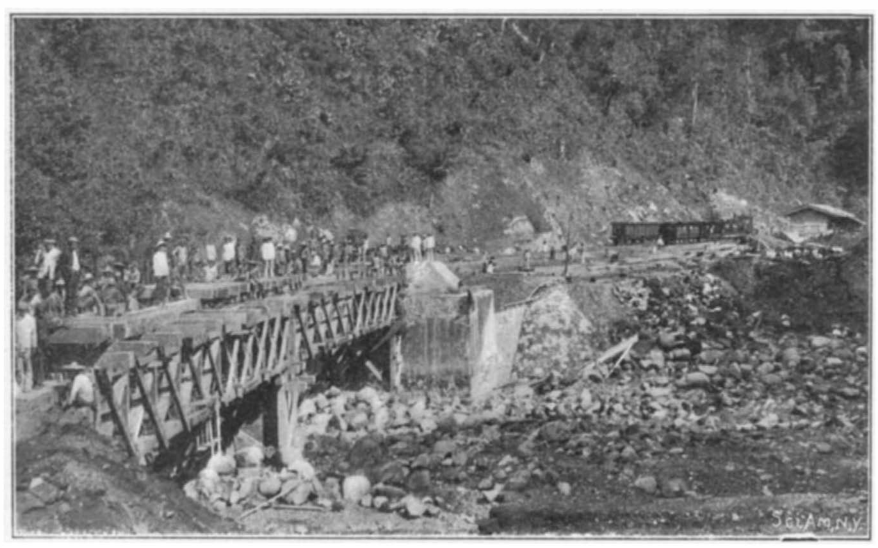


LOOKING DOWN THE TRACK, SUMATRA RACK RAILWAY.

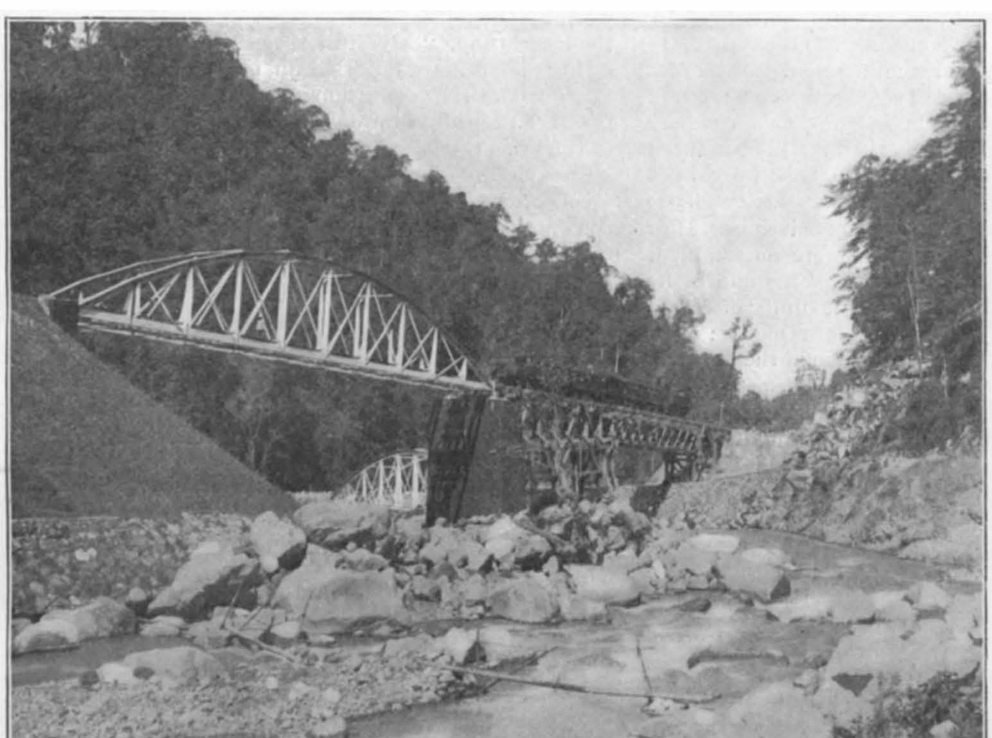
The coal is carried on this line at the rate of 0·76 cent per ton per kilometer. Cars of the American style are used, of 20 tons capacity. The gage of the railway is 1·067 meters, the same as that of the Netherlands State Railways of Java. The heaviest locomotives running on the line have a weight of 35 tons. The rails, 7 meters in length, weigh 25·7 kilogrammes per meter. The cost of the construction of the line was $40,000 per kilometer. H. L. G.



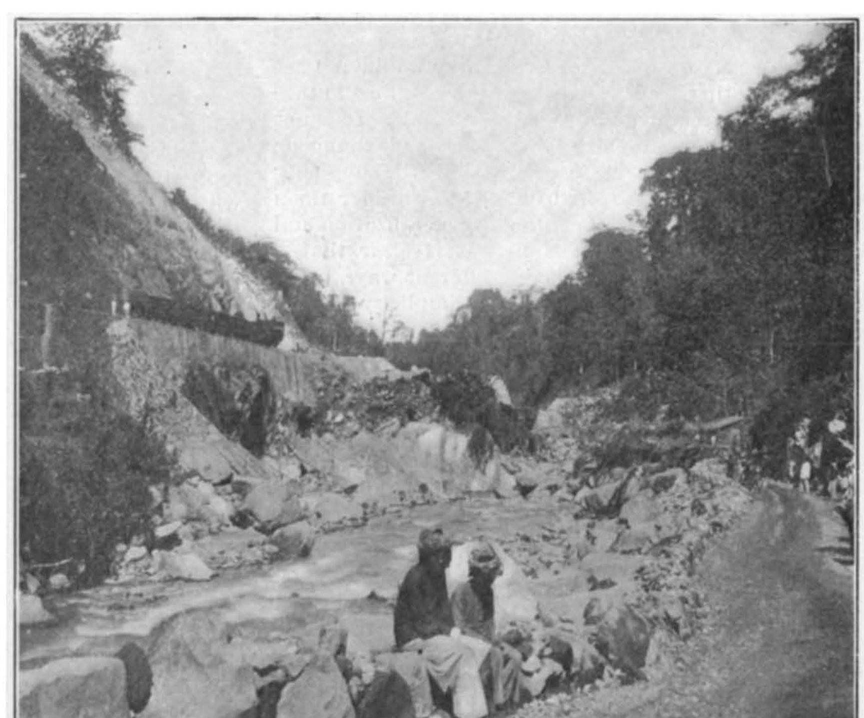
ALONG THE ANEI RIVER, SHOWING TRACK.



THE RAVINE OF THE RIVER ANEI.



THE RAVINE OF THE RIVER ANEI AFTER AN INUNDATION.



RIVER ANEI.

Making Bricks from Glass-Works Refuse in England.

Dr. Ormandy, of St. Helen's, formerly master of science at the Gamble Technical Institute, that city, has recently discovered a process by which good furnace bricks can be made from glass-works refuse. St. Helen's, which is a few miles from Liverpool and within that consular district, is not only the center of the English chemical trade, but contains a number of large glass-works. The millions of tons of refuse which have accumulated around the glass-works heretofore have been treated as of no commercial value. The refuse consists mainly of spent sand, minute particles of glass, and about 3 per cent of iron from the various processes, and it has hitherto been considered that the presence of the iron prevented the use of the material for the manufacture of bricks. Patents have been taken out to protect the process, and a large firm has engaged Dr. Ormandy's services. After making various experiments, the firm is now putting up an extensive plant for the manufacture of the bricks. It is claimed that the bricks will stand a great amount of heat. They are about the color of silica bricks and can be glazed. Considerable secrecy is observed as to the process.

THE temperature of the free air is the title of a paper communicated by Dr. Hergesell to Part V. of Petermann's Geographische Mittheilungen. The author's observations show that even at a height of a few hundred meters there is a very small diurnal range; at night time it amounts, in some ascents, to only a few tenths of a degree, and in the day time, at about 800 meters, to some 3° or 4° Cent., when solar radiation is unobstructed. On cloudy days, and in the mean values, the daily amplitude is much less. With respect to the vertical increase of temperature, the results of thirty sets of observations show that in all levels up to 10,000 meters an extremely varying temperature obtains, according to the season of the year and the conditions of weather. The decrease at that height reached or exceeded 40° Cent. in all cases, but no fixed rule could be laid down as to the regular decrease with altitude.

Correspondence.

Electric Fire Pumps.

To the Editor of the SCIENTIFIC AMERICAN:

The general introduction of the electric motor into buildings of all classes suggests an application which might, under certain conditions, prove to be of great value. A fire pump designed to be driven by an electric motor would, it seems to the writer, have many decided advantages. In large manufactories and public buildings, where steam boilers are kept continually under pressure, there is no difficulty in maintaining fire pumps capable of supplying one or more streams with the necessary promptness. There is, however, a large class of buildings, in which may be included private residences, where steam power is not at hand, and where reliance must be placed entirely upon the local fire department, which may or may not be efficient, and which, at the best, must consume a certain amount of valuable time in getting to work. In such cases it is believed that an electrically driven pump would find its most useful application. Such a pump would be in constant readiness for action, and could be instantly started at any time by the simple pressure of a button, or could even be arranged to start automatically in connection with a system of electric fire alarms, or by releasing the air in the discharge pipes, as in the well-known sprinkler systems. It should be provided with relief valves set at the desired pressure, so that, after once being started, it would run at full speed, the amount of water delivered being regulated at will by the hoseman up to the full capacity of the pump. The apparatus should, if possible, be installed in a small detached building or shelter, where it would not be disabled by fire or by the cutting power of wires leading to a burning building. WILLARD P. GERRISH.

Harvard College Observatory, Cambridge, Mass., October 24, 1900.

[The suggestion of our correspondent is a good one. We believe that this method of equipment has already been installed and with success in some buildings in this city.—ED.]

The Relations between Experimental and Mathematical Physics.*

M. HENRI POINCARÉ BEFORE THE CONGRESS OF PHYSICS.

ROLE OF EXPERIMENT AND GENERALIZATION.—Experiment is the only source of truth, and by its means alone can we learn anything new or certain. What place remains then for mathematical physics? The latter has rendered undeniable services, because it is necessary not only to observe, but to generalize; it is this which has been done from all time, only as the remembrance of past errors has made man more circumspect, he has come to observe more and generalize less. Should we not be content with experiment alone? That is impossible, and would be to ignore the true character of science, which is built of facts like an edifice, but is not a mere conglomeration of material. A good experiment teaches us something besides an isolated fact; by its means we may predict and generalize. Thus each fact observed enables us to predict a great number of others, but we should not forget that the first alone is certain and all the rest are only probable. The role of mathematical physics is to guide the generalization so as to increase what may be called the efficiency of the science. It remains to be seen by what means this may be accomplished.

THE UNITY OF NATURE.—All generalization supposes in a certain degree the belief in the unity and simplicity of nature. For the first there can be no difficulty; if the different parts of the universe were not like the organs of the same body, they would not act upon each other, and we have only to ask how nature is one. The second point is more difficult. It is not sure that nature is simple; modern ideas have changed; but those who do not as formerly admit the simplicity of the natural laws are often obliged to consider them from this standpoint, otherwise all generalization and all science would be impossible. It is clear that a given fact may be generalized in different ways. The choice is guided by considerations of simplicity; this is illustrated by our method of drawing a curve between a series of points. To sum up, every law is supposed simple until the contrary proof is given. If we study the history of science, we find two phenomena of opposite character; at times simplicity is concealed under complex appearances, and at others apparent simplicity conceals a series of complicated phenomena. The complicated movements of the planets and the law of Newton is an example of the first, and the kinetic theory of gases and Mariotte's law is an example of the second case. But Newton's law itself has perhaps only an apparent simplicity, and may be due to some unknown and complicated mechanism. No doubt if our means of investigation become more penetrant, we will discover the simple under the complex, then the complex under the simple.

ROLE OF THE HYPOTHESIS.—Every generalization is a hypothesis, and the hypothesis therefore has a necessary role which has never been disputed. It should, however, be verified as often as possible, and if not sustained, should be abandoned, and even in this case renders great service by the new outlook given. Then, under what condition is the use of the hypothesis dangerous? Those which are made unconsciously we are powerless to abandon; a service may be rendered here by mathematical physics obliging us to formulate all hypotheses. We should distinguish different kinds of hypotheses, those which are natural, and a second category which may be called indifferent, as the results of calculations are not changed thereby; for instance, the continuous or the atomic constitution of matter. These are never dangerous if their character is not lost sight of, and they may be useful in calculation or to give a concrete idea. Hypotheses of a third category are veritable generalizations, and should be sustained or condemned by experiment.

ORIGIN OF MATHEMATICAL PHYSICS.—The efforts of scientists have always tended toward resolving the complicated experimental phenomena into a great number of elementary phenomena, and this in different ways. As to time, each phenomenon depending upon that the preceding instant. In space, in an analogous manner, each molecule acting upon its neighbor.

The knowledge of an elementary fact permits us to put the problem into an equation, and integration becomes possible. The reason that generalization takes usually a mathematical form in the physical sciences is that not only are numerical laws to be expressed, but the observed phenomenon is due to a great number of elementary phenomena, similar among themselves, introducing naturally the differential equations.

SIGNIFICANCE OF PHYSICAL THEORIES.—It may be said that scientific theories are of an ephemeral character, but the role of such theories must be taken into account. The theory of Fresnel has given place to that of Maxwell, but the former has none the less its value in the prediction of optical phenomena. If the relations expressed by the equations are known, it makes little difference whether the image we give to the phenomena change or not. The kinetic theory of gases has given place to many objections, but it has, nevertheless, produced valuable results, no matter whether its absolute verity is affirmed or not.

PHYSICS AND MECHANISM.—Most theorists have a predilection for explanations borrowed from mechanics or dynamics. Some of them wish to explain all phenomena by the movement of molecules attracting each other mutually according to certain laws; others wish to suppress attractions at a distance, and the molecules would thus follow straight paths and be deviated only by shocks; still others, as Hertz, suppress also the forces, but suppose the molecules are bound in a system analogous to our articulated systems, thus reducing dynamics to a kind of kinematics. Phenomena may be explained by all these systems. As to the conception of the ether, some regard it as the only primitive, or even the only real matter, and what we call matter as constituted of vortex motions of the ether according to Lord Kelvin, or according to Riemann of points where the ether is constantly destroyed; or with more recent authors, Wiechert or Larmor, of points where the ether has undergone a special kind of torsion. The old fluids, caloric, electricity, etc., have disappeared, not only when it was found that heat was not indestructible, but the unity of nature forbids the creation of such independent fluids.

ACTUAL STATE OF THE SCIENCE.—Two diverse tendencies are observed in the development of physics, that of co-ordination, in which science advances toward unity and simplicity; and that of variation, where, by the discovery of new phenomena, science appears to advance toward variety and complication. If the first of these is to prevail, science becomes possible; but if on account of the multitude of phenomena we are obliged to abandon our classification, it will be reduced to a mere registration of facts; as to this, we cannot reply, but we may compare the present state of science with the preceding, and draw some conclusions. Half a century ago, the greatest hopes were entertained. The discovery of the conservation of energy and of its transformations had just revealed the unity of force; heat was explained by molecular movements; their nature was not known, but the solution of the problem seemed near; for light, the question seemed solved. Electricity, just annexed to magnetism, was farther behind, but no one doubted that it would take its place in the general unity, and for the molecular properties of solids, the reduction seemed easier. In a word, great hopes were entertained. What do we observe to-day? First, an immense progress; the domains of electricity, light and magnetism now form but one. The optical phenomena enter as particular cases of electrical phenomena. While they remained isolated, it was easy to explain them, but now an explanation to be acceptable must enter into the domain of electricity; this is not without some difficulties. The theory of Lorentz is the most satisfactory; Larmor goes still farther and seems to add to the former ideas of MacCullagh upon the direction of ether movements. However, we have not as yet a satisfactory theory. We should limit our ambition and not seek to formulate a mechanical explanation, but show that we could at least find one; we have succeeded in this, owing to the principle of the conservation of energy and that of least action, both constantly verified. The irreversible phenomena are more intractable, but are brought into order by Carnot's principle. The role of thermodynamics has greatly increased, and we owe to it the theory of the pile and of thermo-electric phenomena. To sum up, the old phenomena become better classified, but new ones are constantly coming in, and we must now place the cathodic and X-rays, those of uranium and radium, etc. No one can predict the place they are to occupy, but no doubt they will fit into the general unity. On one hand, the new radiations seem allied to the phenomena of luminescence; above all, it is thought that in these phenomena are found the veritable ions, these being endowed with a great velocity.

We not only discover new phenomena, but the old ones appear under an unlooked-for aspect. Nevertheless, the relations which we recognized between the supposedly simple objects hold good when we learn their complexity, and this is the essential point. Our equations become more complex, but their form remains. Lastly, the physical efforts have invaded the domain of chemistry, whence the new science of physico-chemistry, which, though recent, enables us to associate phenomena such as electrolysis, osmose and movements of the ions. From this rapid exposé, what are we to conclude? Everything considered, we have approached a unification; though the progress has been less rapid than was hoped for fifty years ago, and the path laid out has not always been taken, we have, in fact, gained considerable ground.

* Abstract by Paris Correspondent of the SCIENTIFIC AMERICAN.

THE AEROSTATIC EXHIBITS AT PARIS.

The aerostatic section of the Champ de Mars contains a centennial collection of great interest; the objects have been loaned by a number of persons who have private collections. The upper illustration shows part of a famous collection which has been loaned by M. Albert Tissandier. These objects, many of which date from the last century, all bear a representation of a balloon, either of the primitive hot air balloon of Montgolfier or the later form inflated with gas. Most of the porcelain and earthenware plaques and other pieces date from the last century, and are decorated with balloons or carry scenes of balloon ascensions more or less artistically drawn. One of these plaques bears the date 1785, and another is dated 1820. A large collection of fans will also be noticed; they all carry scenes of balloon ascensions painted in miniature; and some of these have a considerable artistic value. Two of the fans represent ascensions which were made in the last century at the Tuilleries or at Versailles. In the foreground is a collection of miniatures in round or square metal frames, representing balloon ascensions, and several books with a balloon stamped in gold on the cover. Near it is a collection of miniature boxes in colors or of carved ivory, gold, or enamel, upon all of which a balloon is represented. Most of these boxes date from the end of the last century, and some of them are finely executed. In this collection is a miniature, inclosed in a square leather case, representing "the ascension of Pilatre de Rozier and De Romain at Boulogne, with a balloon filled with inflammable air, on the 12th of June, 1785." Another miniature commemorates an ascension made on the 2d of March, 1784. At one end of the case is a collection of watches, medallions, rings, and like objects, as well as a number of miniatures. Among these is a button of the uniform worn by the military aerostatic corps of 1794; it bears the inscription, "Aerostatier, 1r. Brigade." An interesting relic is a watch with an engraved copper case bearing the representation of a balloon, which was presented to Captain Coutelle in 1794. Another watch of the same period is of steel incrusted with gold, and bears a design of a balloon ascension.

One of the miniatures shows a gas balloon, and bears the date of December 1, 1783, and an engraving in a metal frame, representing an ascension made by Messrs. Robert and Hutin at the Tuilleries on the 19th of September, 1784. In the front of the case is a series of medals which commemorate the different ascensions made during the siege of Paris, 1870 to 1871. In the center is a large medallion in bronze, bearing a figure of the Republic, with a balloon in the background. Surrounding it are a number of small medals which relate to different ascensions. At that time most of the large railroad stations of Paris were turned into balloon headquarters, from which the ascensions were made. The medals bear inscriptions similar to the following, surrounding a balloon in the center: "Depart from the Northern Station—the Torricelli—conducted by the marine Bely—the 24th of January, 1871." The other side of the case contains a large collection of engravings and documents relating to aerostatics. Some of the oldest of these show different forms of Montgolfier balloons, most of which were of a highly ornamental character; among the books and pamphlets is one dated 1784, relating to the experiments of Montgolfier and a copy of the proceedings of the Académie des Sciences of 1828 containing a eulogy of

Aeronaut Charles, one of the pioneers of the last century. Another copy of the proceedings of a much later date is that containing an account of an ascension made by the late M. Gaston Tissandier in the balloon "Zenith," in which he made the remarkable altitude of 24,000 feet. Another part of the collection shows a number of miniature photographic dispatches made upon films, which were used for the post established by carrier pigeons in 1870 to 1871 between Bordeaux and Tours. Each of these films, which measures one by two inches, represents a reduction of sixteen folio pages, and contains more than three thousand dispatches; one hundred thousand dispatches of this character weigh only fifteen grains. The films were rolled in a goose-quill tube and attached to the tail of the pigeon.

Another interesting collection is that of M. Louis Bereau, a part of which may be seen in the second illustration. At the top are a number of very curious engravings relating to balloon ascensions or to different projects for flying machines. One of the latter, designed by E. Petin, contained four balloons with a complicated rigging; under it is a design of flying machine presented to the Académie des Sciences in 1851, by Emile Gire; the balloon was filled with superheated steam and carried a series of immense wings. Another of these machines, with a cigar-shaped balloon carrying the propelling and steering mechanism, made an ascension from the Champ de Mars in 1834. The most interesting of these engravings, the third of the top series, is that representing one of the first public ascensions of Montgolfier, and the text merits a reproduction in full, as showing the state of the art at that period: "Aeronautic experiment made at Versailles on the 19th of September, 1783, in presence of their majesties the royal family and more than 130,000 persons, by Messrs. de Montgolfier, with a balloon 57 feet high and 41 feet in diameter. This splendid machine, with a blue background carrying the king's coat of arms and divers ornaments in gold color, displaces 37,500 cubic feet of atmospheric air, weighing 3,192 pounds, but the vapor which fills it weighing one-half less than the common air, there results a rupture of equilibrium of 1,596 pounds, owing to which the machine and its cage, containing a sheep, a cock, and a duck, will rise, and could yet lift 696 pounds. At one o'clock a cannon stroke announced that the balloon was to be filled; eleven minutes after a second announced that it was full, and at the third stroke it started. It then rose majestically to a great height, to the surprise of the spectators amid the acclamations of the public. It remained some time in equilibrium, and descended slowly eight minutes after in the wood of Vaucresson. The animals were not at all inconvenienced."

AEROSTATIC SECTION OF THE PARIS EXHIBITION—COLLECTION OF M. ALBERT TISSANDIER.

AEROSTATIC SECTION OF THE PARIS EXHIBITION—COLLECTION OF M. LOUIS BEREAU.

In the center of the collection is a curious tavern-sign dating from 1678, representing a man flying by means of paddle-shaped wings attached to rods and supported over the shoulder. The lower case contains a great number of photographs and documents relating to the subject. A large marble tablet contains a dedicatory inscription to the Montgolfier brothers by the citizens of Dannonay, and bears the date 1783 and a design of a balloon. Another tablet relates to an ascension made by Prof. Charles Guy from the Champ de Mars in 1783. At the top is the royal coat of arms, and below is a balloon. The collection includes a number of books; one of these, dating from 1784, bears the title, "The Art of Voyaging in the Air, or the Balloons; containing the means of making aerostatic globes according to the method of Messrs. de Montgolfier and the processes of Messrs. Charles and Robert." The frontispiece contains an engraving of a balloon. Another work of the period is entitled, "Essay on Aerial Navigation," containing the art of directing aerostatic balloons at will; read before the Académie des Sciences, January 14, 1784.

The rear of the case contains a collection representing the Aeronautical Society which was formed during the siege of Paris. One of the interesting objects is a stuffed carrier pigeon, which inaugurated the Aerial Post during the siege; this pigeon made four trips from Paris to Bordeaux, each time carrying a number of dispatches; it was killed while on its fourth trip. With it are shown the reduced copies of the dispatches, made upon films. A piece of the balloon "Washington" is shown near it; this being one of the balloons which figured at the siege; also a basket in which the carrier-pigeons were kept during the ascensions. The collection contains a number of photographs and engravings of ascensions made during this period.

Turf as Fuel.

Consul Hughes, of Coburg, September 6, 1900, says: At the present price of coal, says the Oesterreichische Zeitschrift fuer Berg und Huettenwesen, the use of turf commands our special attention. Hitherto, all attempts to use turf as fuel and for the production of gas on a large scale have failed, for the reason that no means existed to dry it cheaply and quickly, nor could it be pressed into a small volume. Turf contains about 75 per cent of water, of which it loses very little in ordinary "drying." It is now proposed to reduce the turf to pulp and destroy the fiber, after which the mass is easily dried, getting quite hard and furnishing an excellent charcoal. There is no reason why this turf coal should not be used for electric stoves and in the manufacture of carbide of calcium. In distilling the turf coal, paraffin, ammoniac, and a strong illuminating gas are found. In using it as a fuel for locomotives, a heat equal to that of 93·25 per cent of best coal has been attained, while it shows only 2·62 per cent of ashes, thus being equal in purity to high-grade Derbyshire coal. The cost of converting turf into coal has been calculated at 61 cents per ton.

Memorial to John Ruskin.

A simple and beautiful memorial, which has been subscribed for by friends and admirers of the late Mr. Ruskin, was recently unveiled at Friars' Crag, Keswick. The monument consists of a simple monolithic block of Borrowdale stone, rough and unhewn, as it came from the quarry. It is of the type of the standing stones of Galloway, which are the earliest Christian monuments of the Celtic people now extant. Upon one side is incised a simple Chi-Rho inclosed in a circle after the fashion of these earliest crosses, with the following inscription beneath from "Deucalion," Lecture xii., par. 40: "The Spirit of God is around you in the air you breathe—His glory in the light you see, and in the fruitfulness of the earth and the joy of His creatures—He has written for you day by day His revelation, as He has granted you day by day your daily bread." On the other side of the monolith, facing the lake and the scene which Ruskin once described "as one of three most beautiful scenes in Europe," is a medallion in bronze, the work of Signor Lucchesi, representing Ruskin as he was in his prime, in the early seventies. Above the portrait is the name "John Ruskin;" beneath are the dates MDCCCXIX. to MDCCCC. Beneath these again is incised the inscription, "The first thing that I remember as an event in life was being taken by my nurse to the brow of Friars' Crag, Derwentwater."

The Current Supplement.

The current SUPPLEMENT, No. 1296, contains many articles of unusual interest. "The Ferry-Bridge at Bizerta" describes a very curious suspended bridge. "The Paris Exposition Awards" are analyzed. "Electrical Machines at the Exposition of 1900" is a most elaborately illustrated article, giving illustrations of all of the large generators. "Chemical and Technical Education in the United States," by Prof. C. F. Chandler, is continued. This is one of the most important papers ever published in the SUPPLEMENT. "The Twin-Screw Steam Yacht 'Arrow'" is illustrated by a number of engravings. "The Age of the Earth," by Prof. W. J. Sollas, is concluded in this issue.

Contents.

(Illustrated articles are marked with an asterisk.)

RECENTLY PATENTED INVENTIONS.

Engineering Improvements.

CARBURETER FOR EXPLOSION-ENGINES.—HUBERT C. RAY, Visalia, Cal. The carbureter comprises an exhaust-heated carbureting-tank and engine-heated air-supply discharging beneath the oil in the carbureter. An engine-supply pipe connects the carbureter and engine. A combined oil-supply and surplus-gas condenser is also provided consisting of a tank having a pipe for conveying oil to the carbureter, and a pipe leading from the gas-space of the carbureter to beneath the oil-level in the supply-tank and provided with a safety-valve. With this carbureter crude oils can be used instead of refined petroleum or gasoline.

Mechanical Devices.

AUTOMATIC CAGE-REST.—MARTIN HORST, North Lawrence, Ohio. The object of the invention is to provide a new and improved cage-rest which is simple in construction and automatic in operation, moving instantly into an active position in order safely to support the cage at the top of a shaft or mine. The invention comprises supports for the cage and mechanism controlled by the cage and connected with the supports to hold the latter in open position in its ascent. The supports immediately move into a closed position when the cage has passed above them.

ELEVATOR.—PARLEY D. ROOT, Wakefield, R. I. Safety-doors for shafts have been devised, and a novel car which travels in the shaft. The doors at the floors of the shaft and the door in the elevator are independently mounted and yet so arranged that, while both sets of doors are closed, the car can freely pass up and down the shaft. When, however, the car is stopped at a floor and its door is opened, the door in the shaft at that floor will be simultaneously opened; for the two doors will at that time be brought into interlocking engagement, and one will operate with the other. The car cannot move up or down when a door is open.

CULINARY MASHER AND STRAINER.—RICHARD F. HAYES, Manhattan, New York city. This device can be attached to any suitable support, and by its means food can be quickly mashed and soups clarified. The device is so constructed that the sieves through which the material is to be pressed can be conveniently changed to suit the different conditions of material to be treated and that the device can be applied with the use of but one hand. The parts can be easily disconnected and cleaned.

TYPE-WRITER.—ROBERT J. MINER, Greenwich, Conn., and WILLIS E. MINER, Roselle, N. J. This machine is a typewriter for perforation, so that by the ordinary manipulation of the keys a stencil-sheet can be formed from which any desired number of copies can be taken by means of an inked roller, the ink being forced through the perforations to the paper beneath. The machine is therefore particularly useful in railway offices, where a large number of way-bills or the like are required. Either the stencil-type or the ordinary type for printing can be operated by a single bank of keys.

Miscellaneous Inventions.

GOLD-UNDERGLAZED KERAMIC DECORATION.—GEORGE W. TOOKER, 48 Murray Street, Manhattan, New York city. The purpose of this invention is to apply gold decoration to porcelain and glassware so that it will resist the action of alkaline and abrasive substances and will last as long almost as the article to which it is applied. On the china or glassware precipitate of gold is first applied. The article is then fired and the gold surfaces burnished. A glaze is then applied to the gold surfaces and the article again fired at a temperature lower than that of the previous firing. The glaze is now fused and the gold made a corporate part of the ware. The inventor states that the glaze is impervious to alkaline substances and proof against abrasion. This invention is applicable to the following: Household and fancy china, toilet ware, bath tubs, wash basins, water closets, tiling, false teeth, glass ware, etc.

FOUNTAIN-PEN.—CARL J. RENZ, Manhattan, New York city. The invention is so conceived that the pen can be partially or entirely drawn within or without the nozzle by means of a key at one end of the barrel, to vary or entirely cut off the ink. An independent metal feed is employed as an upper or an under feed. The barrel is provided with a piston and stem, the latter having a screw connection with the barrel. The stem has a pen-carrying head which serves as a valve for the socket or nozzle, whereby when the piston is moved in one direction the ink is drawn by suction into the barrel from the pen, and when moved in another direction the ink is forced from the barrel to the pen.

Designs.

FLASK.—JEREMIAH QUINLAN, Manhattan, New York city. The design consists of a flask which in general contour and appearance resembles a shirt.

MARINE PROPELLER.—CARL RONDELL, Stillwater, Minn. The principal features of this design are, first, the arrangement of the radial propeller-blades in a spiral line around a cylindrical hub, and, secondly, the form of the blades, the same being concavo-convex and straight on their entering or cutting edges and convex on their opposite ones.

TEAPOT.—AUSTIN F. JACKSON, Taunton, Mass. This patent is for an ornamental design for a teapot, involving a scroll-work center piece, and floreated and foliated sprays, including daisies, wild roses, and a conventional rosebud.

SAW-SET AND GAGE.—LEWIS VALENTINE, Claquato, Wash. The device is particularly adapted for setting cross-cut saws. An oval handle is adapted to be held in the hand while supporting the device with three of its face projections against a saw-blade so that the fourth projection may gage the angle or lateral inclination of a saw-tooth, and also while the flat end of the device is held against a saw-tooth when the latter is struck with a hammer, for giving it more or less inclination.

NOTE.—Copies of any of these patents can be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7985) R. N. T. writes: In my home I have two long distance telephones in series; one is a wall and the other a desk phone. When I wish to use my desk phone, I short-circuit the wall phone by means of a switch that I have before me, and I have observed that the mere act of closing that switch calls central. Can you tell me why? Because of the novelty connected with it and because of its convenience, I use the switch entirely, instead of the generator, for calling central. A. We suppose your telephones are always in connection electrically with the central office, so that the call bell may be rung when you are wanted. When you shift the switch over for the purpose of cutting out the wall instrument and cutting in the desk telephone, you break and make again the connection with the central office. This of course gives a signal at the office, just as if you had broken and made the circuit for the purpose of giving a signal.

(7986) R. P. A. asks: Have you the plans for a small motor to be run with about from 12 to 18 volts? A. See SUPPLEMENT, No. 641, price ten cents, for the plans of a motor which can be made cheaply and is just what you want.

NEW BOOKS, ETC.

DIE EISENKONSTRUKTIONEN DER INGENIEUR-HOCHBAUTEN. Ein Lehrbuch zum Gebrauche an Technischen Hochschulen und in der Praxis. Von Max Foerster. Third Part. Post Octavo. Illustrated. Leipsic: Wilhelm Engelmann. New York: Gustav E. Stechert, 9 East Sixteenth Street. 1900.

The third part of Prof. Foerster's admirable text-book is devoted to a very thorough discussion of trussed and arched roofs. The clearness and exhaustiveness which characterize Prof. Foerster's work have been more than once mentioned in our reviews of previous parts. This third part fully attains the high standard set in the beginning.

A COMPLETE METRICAL RECKONER. South Omaha, Neb.: Hermann Brothers. 16mo. Pp. 208.

The book is divided into sections from 1 to 100. Folding manila cards at the front and back are turned into place so that any figure from 1 to 100 appears in an aperture which is cut in the card. It is by this means made easy to read off from the calculated weights and measures the exact weight or quantity. The result is a very handy metrical reckoner. In going from the metrical system to the ordinary the card on the right-hand side of the book is used.

PHOTOMETRICAL MEASUREMENTS AND MANUAL FOR THE GENERAL PRACTICE OF PHOTOMETRY. With Special Reference to the Photometry of Arc and Incandescent Lights. By Wilbur M. Stine, Ph.D. New York: The Macmillan Company. 1900. 16mo. Pp. 270. Price $1.60.

The rapid extension of the practice of photometrical measurements in this country, and the general interest in standards of illuminating power and allied subjects, evidenced by frequent contributions to technical periodicals and by papers read before the various associations, has been the occasion for the preparation of this work. The author has produced a most valuable treatise, which will meet the requirements of a large number of readers. The explanations are lucid, and it is well illustrated by engravings and diagrams.

TO INVENTORS.

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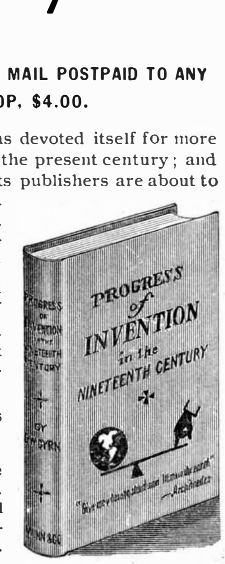

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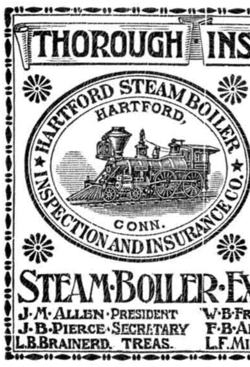

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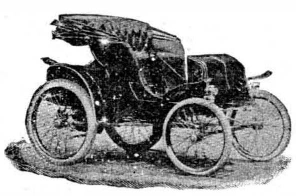

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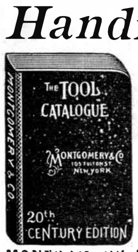

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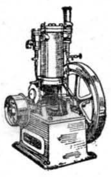

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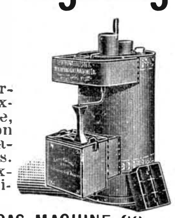

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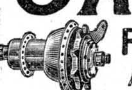

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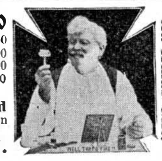

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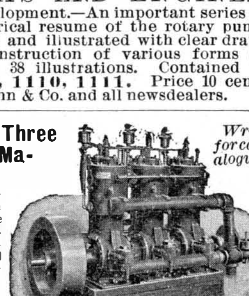

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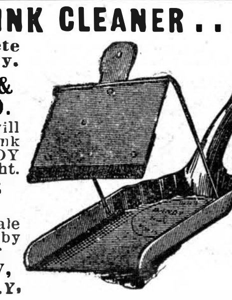

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